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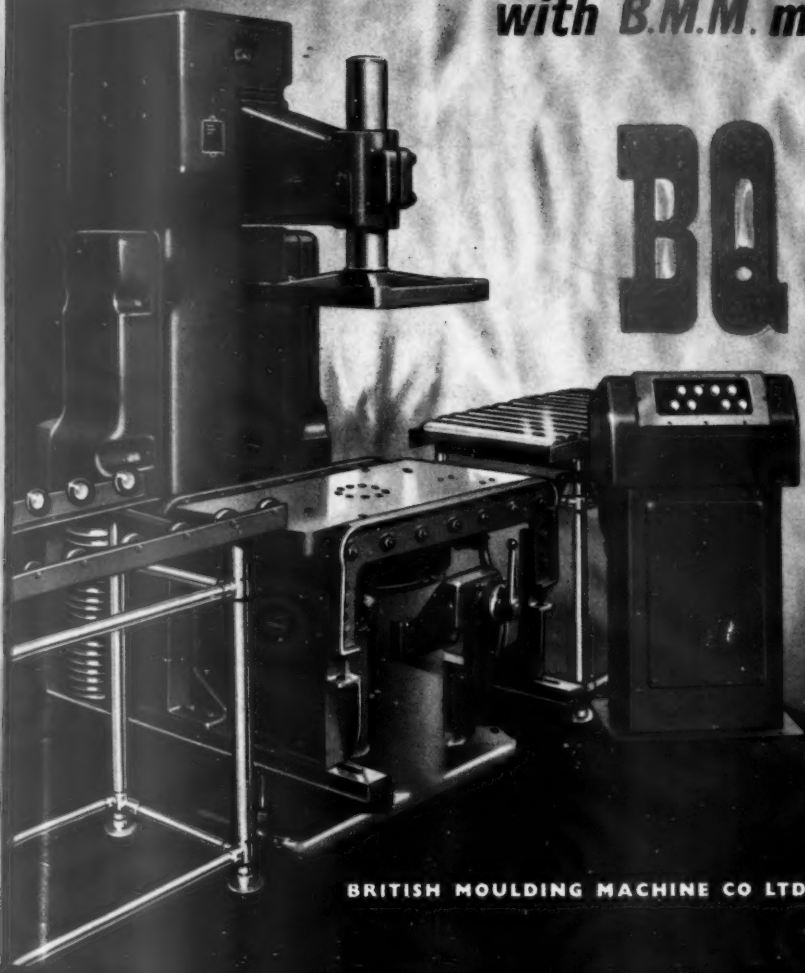

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TRADE JOURNAL

Vol. 104 May 29, 1958 No. 2172

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MODERN FOUNDRY LAYOUT

Photograph published by courtesy of The Hill Top Foundry Co., Limited, Wednesbury

Photograph shows :

A General View of a Section of a large Iron-foundry. One of the main Distributing Belt Conveyors can be seen, for feeding the Mixed Sand to the Moulders Supply Hoppers.

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FOUNDRY
TRADE JOURNAL

Vol. 104 MAY 29, 1958 No. 2172

Britain's Newest Automobile Foundry

Last Tuesday saw the official opening of Britain's largest automobile foundry—the Thames Foundry of the Ford Motor Company, Limited, Dagenham. The building itself is a great civil-engineering achievement, and functionalism and external appearance have been cleverly and happily combined. The choice of site was determined by the proximity of the great manufacturing shops taking its output, this siting in turn being governed by the excellent shipping facilities available. The actual ground is marshy and required extensive piling and this had a major influence on the internal layout of the foundry. No foundry in this country has paid greater attention or indeed spent more capital on the provision of the best working conditions possible, special attention being given to the reduction of dust to the minimum. It is pleasing to record that, by and large, the plant requirements for this huge undertaking were furnished with but little recourse to overseas suppliers. A major exception was the provision of core-trimming machines, where doubt exists as to whether the supply of such machines would be economic so far as the home market is concerned. The fact that confidence was placed in British-made plant should go far to convince overseas concerns of the modernity, size and scope of our foundry plant suppliers.

A visit to this foundry shows it to be a veritable textbook on mechanical handling as applied to castings manufacture, where full use is made of many types of conveyors—their synchronization amounting to "automation"—transfer gadgets, punched-card system for coresand control, all integrated with the machines and their production. What strikes the foundryman most is that out of 1,800 working staff, but comparatively few could be classified as producers, yet it is stated that production per man/hour has been doubled as compared with previous methods of manufacture for the type of castings being made.

An amazing change from the old days is that before the foundations for this foundry were cut, its output was determined and so far as we know, it has been achieved. In the past, when a plant was installed, it went through its "teething troubles" and later, output figures were only then established, but these were, through modifications, often improved upon. The pre-planning of the Thames Foundry was indeed an achievement of no mean order. Whilst other great firms have applied pre-planning with outstanding success, the smaller concerns, when installing plant, should study all such factors as staffing, auxiliary plant and handling of materials to and from the points of production. Such a study will result in the minimization of teething troubles and guesswork. During the next year or so, the Thames Foundry will be visited by hundreds of parties from all types of people and (from the point of view of the foundry industry) nothing but good can eventuate, as in 99 cases out of 100, a new and better impression will be had as to the important place the manufacture of castings occupies in the world of engineering. The description of the plant which occupies the major portion of this issue will confirm this important aspect of this new adjunct to Britain's motor-car production potential.

International Standards Conference

Amongst the technical committees which will be attending the conference of the International Organization for Standardization, to be held at Harrogate from June 9 to 21, those of particular interest to the foundry industry are committee (No. 79) dealing with light metals and their alloys, and that concerned with copper and copper alloys (No. 26). Brief résumés of the work of these committees are as follow:—

Light Metals and their Alloys—Technical Committee No. 79

This three-year-old committee has, in the interests of easier world trading (chiefly to avoid misconceptions between buyer and seller), sought agreement on chemical composition and mechanical testing of aluminium and magnesium and their alloys. The committee has prepared recommendations relating to magnesium ingots and magnesium, alloy ingots and castings; other recommendations for pure aluminium, aluminium-alloy castings, and tensile and hardness testing of light alloys are also at an advanced stage.

Consideration is now being given by the committee to international standards for wrought aluminium alloys, high-purity magnesium and magnesium-zirconium alloys. A suggestion from Canada is that a full designation code should be prepared, for ease of reference, of all alloys under consideration in this committee.

Leader of the British delegation at Harrogate will be Mr. E. G. Robinson of the Northern Aluminium Company, Limited. Other interests represented will be the Aluminium Development Association, the Aluminium Industry Council, and the Magnesium Industry Council.

Copper and Copper Alloys—Technical Committee No. 26

The scope of this ISO technical committee, which first met in Stockholm in 1955, is to achieve international agreement on nomenclature, sampling methods of test and product specifications. The committee secretariat is held by the United States and various proposals, based on standards of the American Society for Testing Materials, are now nearing final approval as world standards; they are concerned with the classification of coppers, the mercurous nitrate test and the expansion test for copper tubes.

Consideration is being given to the classification of cast copper alloys; in this connection British delegates have suggested that B.S.1400, Copper-alloy ingots and castings, might form the basis for international agreement. At Harrogate discussions will be held on the mechanical testing of copper and its alloys and wrought copper alloys.

Leader of the British delegation will be Mr. W. L. Govier of Yorkshire Imperial Metals, Limited, who represents the tube group of the British Non-ferrous Metals Federation. Other interests represented will be the rolled metal and extruded rod groups of the Federation, the Association of Bronze and Brass Founders, the Copper Development Association and DSIR's Mechanical Engineering Research Laboratory.

IT IS REPORTED that since the Brussels International Exhibition opened last month, 143 "serious and detailed enquiries" about the products displayed have been received by the Birmingham Exchange and Engineering Centre.

Dinner

JOINT IRON COUNCIL

Mr. Malcolm J. Glenny was the host at a dinner party held on board the Wellington, by kind permission of the Honourable Company of Master Mariners, given in honour of Mr. J. P. Newman, J.P., and members of the Council of Ironfoundry Associations. Mr. Newman, who has been president of this body for nine years, was, on his retirement, presented with an inscribed silver salver as an appreciation of the services he had given. His health was proposed by Mr. Glenny, whose speech was supported by addresses from Mr. FitzHerbert Wright (the first chairman of the Council of Ironfoundry Associations upon its formation in 1941 until Mr. Newman succeeded him in 1949) and Mr. Arnold Pearce, for many years an active executive and Council member of the organization.

Present also were Mr. D. Graham Bisset and Mr. H. V. Shelton (vice-chairmen, Council of Ironfoundry Associations), Sir Frederick Scopes (chairman, Council of Iron Producers), Mr. C. Bianchi, Mr. H. A. Bonney, Mr. H. E. Cookson, Mr. Ambrose Firth, Mr. J. W. Gardom, Mr. E. K. Gould, Mr. C. J. Grazebrook, Mr. R. H. Halbeard, Mr. M. M. Hallett, Mr. R. L. Handley, Mr. E. Carey Hill, Dr. J. E. Hurst, Mr. G. B. Judd, Mr. A. K. Kirk, Mr. G. E. Lunt, Mr. C. Marley, Mr. E. C. Marsland, Mr. H. A. Redshaw, Mr. J. T. Swift and Mr. S. N. Turner, together with Mr. Kenneth Marshall, director of the Council of Ironfoundry Associations, Mr. J. W. Butler, the assistant director, Mr. D. L. Farrant, the secretary, and Mr. Basil H. Tripp, public relations officer.

Luncheon

FOUNDRY COKE MERCHANTS' ASSOCIATION

An attendance larger than usual participated in the annual luncheon of the Foundry Coke Merchants' Association which preceded the annual general meeting last Thursday. The function was held at the Waldorf Hotel, London, and 45 members were present in support of Mr. E. Tasker (Darley & Company (Birmingham), Limited), who presided. With him at the high table were Mr. C. F. Sullivan, Mr. Leslie O'Connor, C.B.E., Mr. R. J. McDonald, Mr. Arnold Carr, Mr. H. H. Prosser, Mr. W. Armstrong, Mr. W. Pratt, Mr. C. B. Hardwick, Mr. A. Fitter, and Mr. J. C. Martin. During the luncheon, Mr. Tasker welcomed the guests and mentioned apologies for absence which had been received from Mr. Feggetter, Mr. Rudick and Mr. Smart. Mr. Sullivan replied on behalf of the guests, among whom were a number of representatives of the National Coal Board.

At the annual general meeting of the Association, the president and retiring members of Council were re-elected, as was Mr. S. Owen, the secretary and treasurer. During these proceedings, the chairman presented a report on the Association's operations during the past year, which had in general progressed quite smoothly.

THE ASSOCIATION OF BRONZE & BRASS FOUNDERS announces that a meeting of members in the Scotland area is to be held on June 5 at the St. Enoch Hotel, Glasgow, commencing, at 11.30 a.m., with a report and discussion on current activities of the Association. After luncheon (at 1 p.m.) the meeting will recommence at 2.15 p.m. with the showing of three short films, produced in Italy, entitled "Hand and Machine Moulding," "After the Shake-out," and "New Ideas at Work in the Foundry."

New Thames Foundry

This is perhaps the first time in the "Journal's" history that it has been possible to tell the full birth-story of a new foundry in the United Kingdom, which has cost approximately £7¼ million, thus few will deny that the Ford Thames Foundry scheme—on which has been spent that sum—deserves pride of place. Add to that the fact that the new project described in what follows is the "brain-child" of one of the most-forward-thinking groups in the world, then the potential value of this account as a guide for other founders (and not only those on mass-production) begins to appear. Yet discounting all this, the sheer inescapable fact emerges that the account below is long and detailed solely because in no other way could a journal of this standing do justice to the interest displayed among foundrymen the world over in the great many innovations embodied in the new Thames Foundry.

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Introduction

In compiling the following detailed account of Ford's new Thames Foundry, an attempt has been made to display the same logical approach as was made by the Ford engineers—that is, first to define the parameters; next, to take into account limitations of terrain and to base the overall plan on a logical and integrated progression from raw materials to finished product and, finally, to survey and comment on achievements. Main sections of the story which unfolds itself are devoted in turn to:—Introductory remarks; site development and buildings; stockyard and melting plant; sand-treatment; coremaking; moulding and pouring; knock-out and primary cleaning; fettling and dust-extraction. Supplementary comment is included on services, amenities, office accommodation and employee welfare. Finally, a short assessment is made in general terms of the significance of the whole project and its place in the development of the foundry industry, concluding with a note of appreciation for the co-operation received in preparing the "story" for Press.

Background

The Thames Foundry is the largest project in the company's five-year, £65,000,000 modernization and expansion programme to be completed so far. The urgent need of greatly increased casting capacity is illustrated by the rapid growth of Ford production. In 1946, the company was producing some 370 vehicles per day. By 1954, when the expansion programme was launched, production had reached

Note:—The illustration at the head of this report is a view of the Thames Foundry looking north-west.

Ford's Thames Foundry

1,200 a day; now it stands at a record and capacity level, well over 1,800 vehicles per day. It was therefore decided to build a new foundry on a virgin 22-acre site close to the main works—and the Thames Foundry (which was formally opened last Tuesday) is the result. It is designed primarily to cater for the production of cylinder-head, cylinder-block castings and sizeable tractor components on a mass-production scale. The firm's Dagenham foundry is to continue in operation.

From Piling to Production in 2½ Years!

Thus, Ford Motors' production and constructional engineering (K) division was assigned the task of carrying through the project for the new foundry. They consolidated their terms of reference, issued by the Ford management, into an instruction to prepare a scheme for: "building a new foundry to make 325 tons of castings per day of two eight-hour shifts from moulds of unit size and to conform to a given schedule of vehicle-component manufacture." After the incredibly short space of time of 2½ years since the driving of the first pile, "K" division have completed the project, in the form of a fully-mechanized and fully-integrated foundry.

Periods of national emergency and material shortages were encountered and combined to delay the execution of the work, but each was overcome by a high degree of co-operation between Ford's staff and those of their contractors and suppliers. In fact, not a little credit for the satisfactory outcome of the work is due to UK plant suppliers. In quite a number of cases, they were asked to adapt equipment or make new plant to American designs, for which there had been little call in this country, but of which Ford's engineers had gleaned considerable experience from their American counterparts. One beneficial result of this insistence, in some cases, on the use of American designs has been the broadening of UK plant-manufacturers' scope and lines of manufacture, which has the effect of conferring on them a more competitive potential in the world's export markets.

SITE DEVELOPMENT

For building the Thames Foundry, Ford's employed as consultants H. K. Ferguson Great Britain, Limited (UK associates of the US firm of the same name) and this organization entered into a working arrangement with John Laing & Son, Limited—the arrangement being that Laing's did the civil engineering and building work and H. K. Ferguson organized the necessary services, heating and ventilation equipment, electrical installations, gas and water supplies, etc. The work was carried out in the form of a "package" deal, the contractors being responsible for the design and construction of a suitable building to house the various items of productive and subsidiary plant which had been decided upon by the Ford engineers. It meant that initial building construction was taking place while the rest of the detailed design was still under way and decisions on equipment were still being made. The result was a great saving in time, but it will be appreciated that it was a

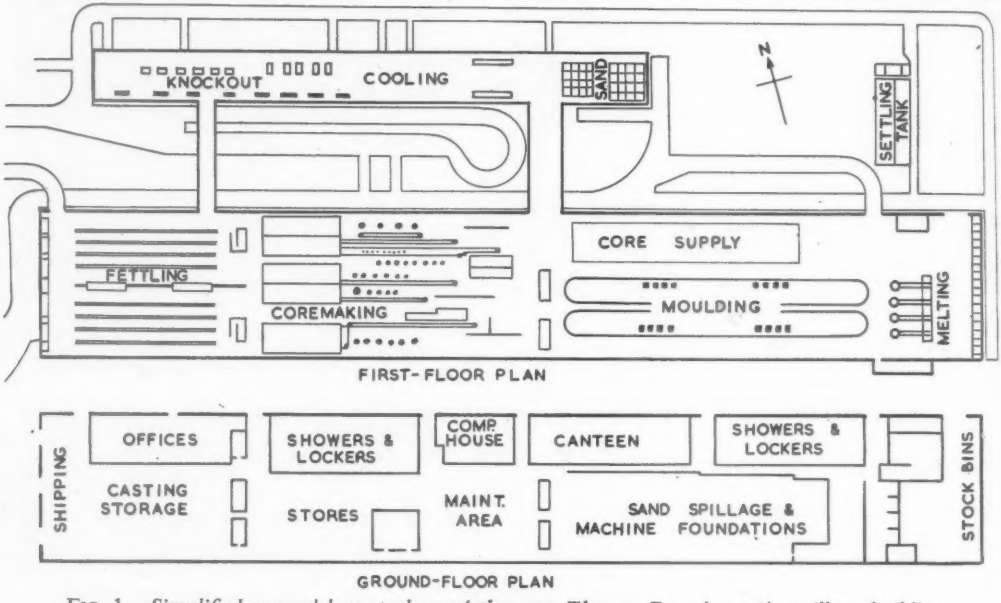


FIG. 1.—*Simplified general layout plans of the new Thames Foundry and ancillary building.*

method which left no room for second thoughts in the initial plans!

In the early days of 1954, while negotiations were proceeding with the contractors, Ford's construction-engineering department arranged the clearing, levelling and piling of the site and placed on order items of equipment for which long periods of delivery were quoted, such as major electrical equipment and switchgear and overhead cranes. The site chosen, north east of the company's Dagenham works, lies on the east bank of the River Beam, that is, actually in the area situated in the Urban District of Hornchurch. It was originally marshland and part had already been the company's refuse tip. The first operation, therefore, was to level the site and import "fill" as required to bring the ground above flood-water mark. Since approximately one third of an orthodox foundry layout of this type would necessitate foundations and services which would require access below the working-floor level (below moulding machines, for sand spillage, etc.), the proximity of the site water-level dictated the advisability of using a ground floor instead of an underground basement for the purposes. Thus, a major decision was made to have the level of the working floor at 14-ft. above the average ground level, making it, in effect, a first-floor foundry. Once made, this decision brought in its train several complementary decisions, for example, it was also ruled that showers, ablutions, toilets, canteens, stores, maintenance shops, medical station, offices and compressor room and such like services should be accommodated at ground-floor level, thus freeing the entire upper working-floor for production operations. It followed that partition walls and access corridors were also incorporated in the ground floor.

Ancillary Building

A second major decision was to house the "dirtier" and noisier of the operations of castings production in a building ancillary to the main block. This necessitated the construction of a second building, also on two floors, parallel to the main building at a distance of 140 ft. from it (see Figs. 1 to 3). In this building, such operations as slurry mixing, handling of coal-dust, sand drying, primary cooling and fettling are, in fact, carried out. Here, the same form of building construction was decided upon with amenities and services, control centres and sub-stations on the lower floor and with the melting, moulding and coreshops on the upper floor level of the main block.

For the main building, 1,200 by 180 ft., a box-type of construction on a square grid (60 by 60 ft.) basis was arranged. The ancillary building, 710 by 60 ft. is connected with the main building by

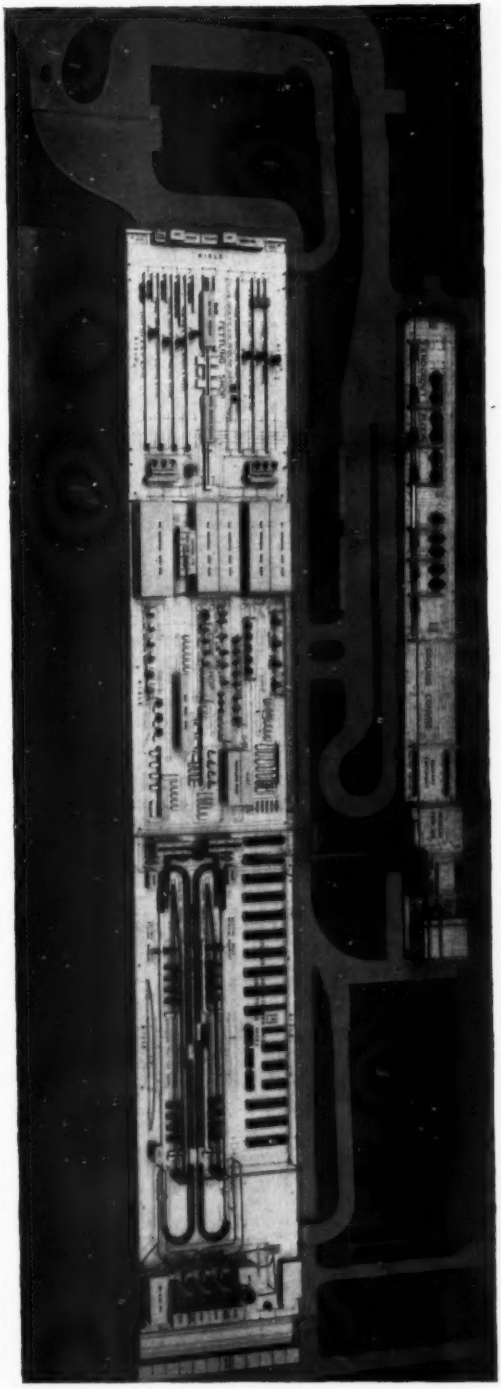


FIG. 2.—*Quite early in the Thames Foundry scheme, a three-dimensional model was constructed. This photograph shows the model at first-floor level. It also shows the arrangement of service roads and bus station.*

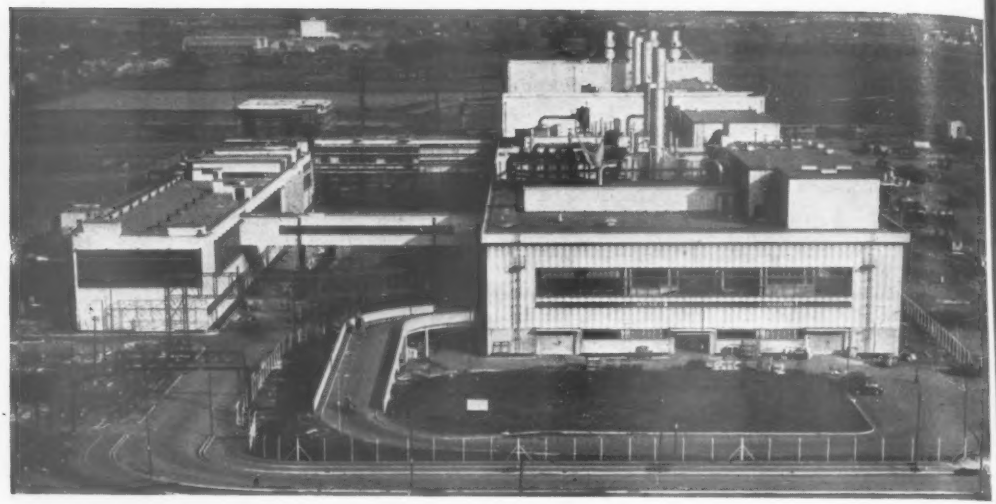


FIG. 3.—*Exterior of the Thames Foundry buildings, looking east.*

galleries, one (that at the west end) being 20-ft. wide and the other 40-ft. wide.

As a further basic feature of the original plan, it was decided that the main operational floor of each building should be left as free as possible for production operations and anything that could be placed with advantage above floor level was to be suspended from the roof. This meant that sand could be stored on high, etc. It also meant that a stronger type of construction was necessary for the building, but the expense of this was justified by the extra working-space thus made available. In addition, it was decided to site on the roof all high-tension electrical sub-stations, with the mains transformers and switchgear for distributing power and light through the building. The high-tension supply of 11,000 v. and this is taken to six sub-stations (and to a rectifier for d.c. supply) for breakdown to low tension close to the operational points. Also, a number of heating and ventilation systems are housed on the roof, in large pent-houses, with built-in ducting for distribution or collection purposes throughout the foundry. The roof also supports dust-extraction equipment and a sluicing system for the removal of dust (Fig. 14).

All the above means that the roof structure is of necessity more of a stressed bridge-type of design than that of a simple roof; loads of as much as 700 tons are carried down the columns. Fabricated steel incorporated in the construction was itself of the order of 7,500 tons. As would be expected, floor loading for foundrywork of this nature is also very considerable and the floors were therefore designed to support 5 cwt. per sq. ft.

Building Details

The marshland site selected for the Thames Foundry overlays a layer of gravel ballast varying in depth from 15 to 20 ft. at about 20 ft. below ground. Thus, all loads from the building had to be transferred to this stratum by piles; some 5,500 of these in pre-cast were driven into the ballast, an operation which commenced on March 15, 1955. The ground floor and first floor (Fig. 15) are constructed as a reinforced-concrete box, capable of taking the floor loads and the supplementary steel superstructure and cladding of the foundry buildings with all their suspended and superimposed loads.

In view of the installation of equipment on the roof and at roof level inside the building, it was not possible to introduce roof lighting, and the walls were designed, therefore, to give maximum side-light window areas, so as to provide the best possible daylight conditions at working-floor levels. Up to 7 ft. above ground, the walls are constructed of reinforced-concrete panels, 20 ft. long, 5 in. thick, cast on site, and above these is glazing comprising 5 by 4 ft. wire-reinforced panes extending a further 16 ft. up. The choice of large panes of glass was dictated by the facility with which these may be kept clean. Still higher is asbestos sheeting to roof level, this being of dual construction—corrugated and plain asbestos sheets with an air space between. The flat roof has been covered with pre-stressed hollow concrete units of from 5 to 7 in. thick (according to location) by 10 ft. long and with a layer of rock-asphalt waterproofing, nominally 1 in. thick, above these. A parapet wall, 3 ft. high, surrounds the building; this is formed of pre-cast concrete units and also incorporates on its inside a drainage channel for roof water.

Glazing on both sides and end and generally similar construction has been adopted for the ancillary building also, except for the incorporation of cooling louvres in the walls adjacent to the casting-cooling conveyor—about which, more later.

FIG. 4.—*Early stage in the building work; piling is completed and machine foundations are being constructed.*

Lighting

Low-level lighting of the building takes the form of 5-ft. fluorescent fittings carried on trunking and of sufficient number and distribution to give 35 lumens intensity at the working floors. In addition, general lighting of 25 lumens intensity has been installed and for this, "High-bay" mercury-vapour lights have been used—this being supplemented by fluorescent low-level lighting at the main working areas. Lighting switches are "banked" for control, section by section. (Incidentally, street lighting in the service roads around the foundry and for the service road leading from the Thames Foundry to the Dagenham/Tilbury highway is by sodium-discharge lamps.)

Heating and Ventilation

Since particular attention has been given during the construction of the main foundry and selection of plant to ensure dust and fume removal from the working areas, it follows that the amount of air being withdrawn from the building and air consumed during process operations is very considerable, amounting, in fact, to 1,250,000 cub. ft. per min. (c.f.m.). Thus, four major fan installations have been made at roof level to replace this air. These incorporate 12 "Sirocco" fans, each of 100,000 c.f.m. capacity. These draw in outside air through a system of fully-automatic viscous oil filters, the purpose of which is to remove any dust or grit. The air then passes through banks of steam-heated batteries, controlled by modulating valves, to give a constant pre-determined temperature. Warm air then passes along built-in ducting, lined and insulated to maintain the temperature and improve flow. From this main ducting, vertical shafts and distributing ductwork within the building then take the clean, warm air to operational levels.

The entire heating system is controlled by thermostats in ducts themselves and at floor level, these being used only in winter. In summer, heat can be withdrawn and the installation then supplies cooling air, and the circulation of this is supplemented by roof extraction-fan units strategically placed. To further control of atmosphere in the foundry, the glazing sections are made to open. These windows are mechanically operated and their movement is thermostatically controlled, according to the conditions inside the building. In addition, the window-opening mechanism is interlocked with the roof-fan control units. It is estimated that the cost for heating and ventilating equipment alone approached £500,000. (The building total was about 3¼ million pounds of the 7¼ million total

FIG. 5.—*Concrete columns and flooring of the main building in position. The holes through the beams are for carrying service pipes and electrical systems.*

FIG. 6.—*Duplex sedimentation tank and main channel—for removal of dirt by sluicing—in course of erection.*

spent in the new foundry and its equipment). To supplement the warm-air inlets and compensate for fabric losses, the perimeter of the main building has been provided with recirculation-type steam-heated radiators at window level.

The ancillary building is heated entirely by steam unit heaters with fresh-air intakes. Owing to the nature of the operations in this 60-ft. wide building, it was not practical to introduce overall clean-air supply. Special asbestos L-shaped louvred construction, however, is incorporated in the cooling gallery walls to give maximum heat dissipation for the castings and to avoid the fine sand dropping from them being carried beyond the building.

Sluicing

Wherever dust is created by foundry operations, the foundry equipment includes extraction plant which conveys dust-laden air to specially-designed wet collectors. The contents of these collectors are discharged into a running stream of water within a mild-steel channel at roof level. This stream is boosted at intervals by high-pressure jets, so as to carry all the material in suspension in the stream. The main sluice discharges into a larger sluice at ground level, where it is joined by the main sluice from the cupolas (carrying granulated slag also). The entire contents of the sluices are then discharged into an open sedimentation tank (Fig. 6) which is approximately 140-ft. long by 40-ft. wide by 20-ft. deep and divided lengthways into two sections. Here, the major part of the solid materials is deposited and the sluicing water passes on over a weir to a discharge sewer. This takes it a distance of 250 yards to two secondary settling/cooling ponds, holding some $2\frac{1}{2}$ million galls. Adjoining these is the main pumping installation which recirculates water back to the head of the sluice and thus completes the circuit. Booster pumps are also in use for cupola-furnace cooling water. In the sedimentation tank, one compartment can be segregated from the other and drained, so that an overhead crane can be employed to clear the sediment from the one part while the other is in use. The total sluice-water throughput is 5,000 galls. per min.

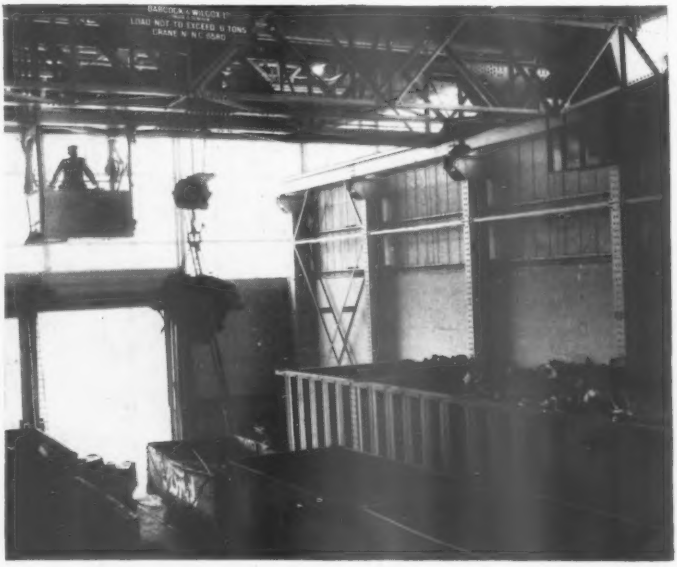


FIG. 7.—*Rail wagons; charging (magnet) crane and emergency-stock bins viewed from the cupola platform at first-floor level.*

STOCKYARD AND MELTING FACILITIES

The layout of the Thames foundry melting plant and stocking facilities are shown in relation to the rest of the main sections in Fig. 1 (a general view of the stockbins being shown in Fig. 7). From this, it will be clear they occupy a position at the eastern end of the main building. (One of the factors influencing this choice of location was the fact that the prevailing winds in this area are from the south-west.) The melting plant comprises four hot-blast water-cooled cupola furnaces, arranged in line, with ancillary services as outlined in the detailed plan of this part of the main building, shown in Fig. 8. The cupola size, as determined by anticipated future melting schedules—was chosen at 108-in. shell diameter, with melting capacities of 30 tons per hour each. Although the four furnaces are identical, the plant really consists of two pairs of furnaces, the idea being to have one of each pair operating together at any given time. The melting area comprises a 70-ft. bay, "Z," for charging and raw-material stock and a 80-ft. bay, "Y," for the furnaces, making a total area of 27,000 sq. ft.

Raw Materials

From the company's sidings, metal stocks are brought inside the end of the foundry by rail track, in the quantities and at the frequency required and material is used for current melting purposes, 18 wagons can be accommodated, Ford pig-iron and steel coming from the company's stock-area (situated about one mile from the Thames works) and back scrap from the processing department of the foundry—the latter also being conveyed in rail wagons. To provide a reserve of metal, there are 10 stock-bins (Fig. 7) along the east end of the building, each 12 ft. high by 15 ft. square; the flooring of these is of "piled" reinforced concrete

FIG. 8.—*Detail plan of the melting plant and metal-stocking facilities at the east end of the main building.*

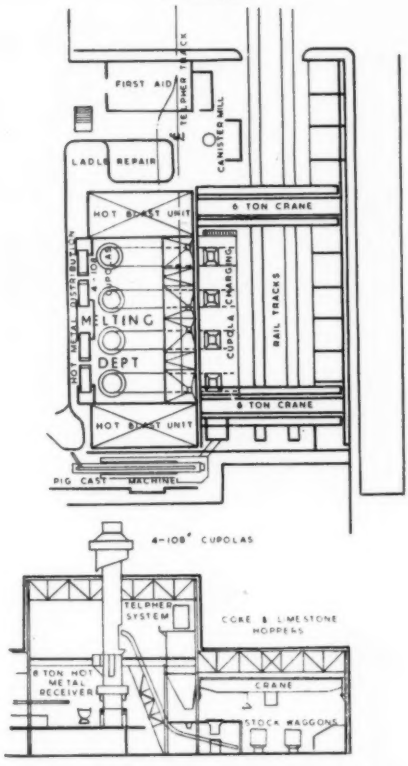
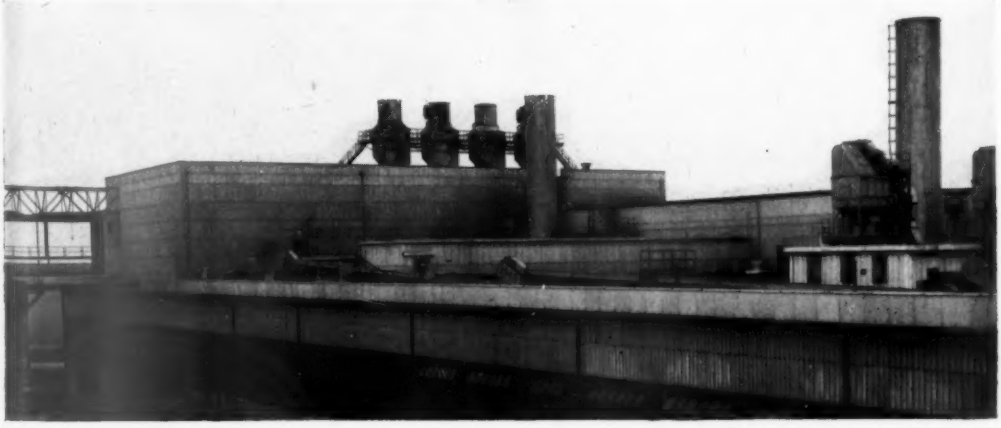


FIG. 9.—*Roof of the main foundry building as viewed from the far end of the east gallery. Note the sluice tower and telpher-crane gantry (extreme left); one of the "En-masse" series of sand conveyors on the near edge of the roof; the cupola spark-arresters, and on the right, dust separators. The two stacks are those exhausting the cooling hoods on the moulding line.*



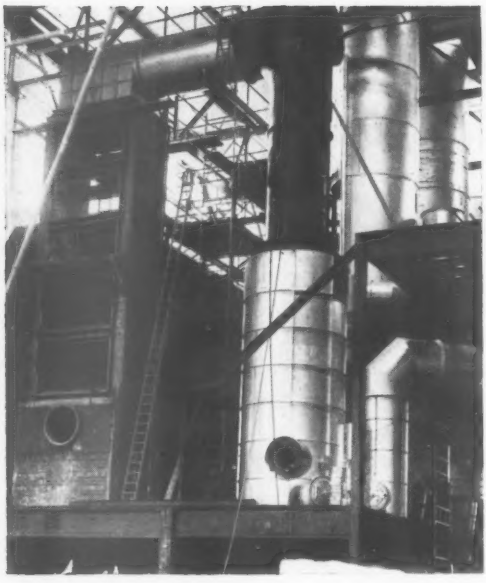


FIG. 10.—*Hot-blast system: Recuperator plant for one of the pairs of cupolas in course of erection.*

with their sides constructed of troughed interlocked steel-sections. Pig-iron of various grades, steel and the back scrap, are accommodated in these stock-bins in an amount sufficient to keep the foundry running in the event of emergency for a period of 1½ days.

Container Transport

Coke comes direct from the Ford coke-ovens at the Dagenham works in special steel-plate containers, each holding 2¼ tons (two containers per flatdeck railway wagon). They are picked up from the wagons by a telpher overhead travelling crane (see Fig. 9) and lowered bodily into a coke-storage hopper, located adjacent to each cupola; the bottom double-doors of the container are then opened so as to give quite gentle release of the coke into the stock-bin to avoid breakage. It should be realized that Ford coke is actually blast-furnace coke and thus, much smaller, softer and friable than that specially prepared for foundry use—hence, the special precautions to avoid further breakage in handling.

Limestone is conveyed, also in containers, to the storage hoppers above the cupola weigh-hoppers from the company's central store-area. In passing, this adoption of container transport is deserving of special notice, because it permits the arrival in the works and delivery to the operating station of a range of materials difficult repeatedly to pick up and put down, and many materials also which produce large amounts of dust if handled in any other way. The system is used at Ford's also for incoming supplies of blacking and coal-dust; Fulbond for the moulding sand is delivered in bulk tankers (similar to those used for cement) and core-oils and the like are also received in pipe-lines from road tankers.

Unloading and Charge Cranes

The stock-bins and incoming rail wagons are spanned by two 6-ton capacity cranes on an overhead gantry of 66 ft. span, 33 ft. high (to crane track), and 180 ft. long travel. One of these is continuously in use and the other main available as a stand-by. Metal is unloaded direct from rail wagons into the weigh-hoppers of the cupolas by a 55-in. dia. electro-magnet. If make-weight additions to individual charges are required, material for these can be stored in small quantities on the cupola charge platform, which runs the whole width of the bay between the furnaces and the rail tracks. This fabricated-steel platform is level with the tops of the charge-weigh-hopper at each furnace and also accommodates the charge-weighing-machine indicators.

Sand for the cupola bottoms and Sheffield-type ganister is brought into the works, also in wagons, on the same rail tracks and unloaded on this charging platform by grab bucket handled from the crane. Ganister is prepared for use in the furnaces by a pug mill; at the present time, its rate of consumption for patching the furnaces approximates to 23 lb. per ton melted.

Furnace Installation

As already stated, there are four hot-blast cupolas installed, each of 30 tons per hr. nominal capacity, their shell diameter being 108 in. At present, they

FIG. 11.—*Part of one of the two cupola control panels, as viewed through the cubicle window.*

FIG. 12.—*General view of the battery of four, eight-tons capacity, hot-metal receivers in front of the cupolas.*

are lined with 9-in Glenboig refractory bricks, A and A.1 quality. For the initial campaign, standard-size bricks have been employed, but it is possible that a special-shape block may be employed for re-lining when this is required. The cupola stacks are parallel sided and carry wet cone-type spark-arresters. It is again interesting to record that each spark-arrester has been fitted with a branch take-off to allow for the future installation, if required, of cupola effluent gas-washing equipment; in this event, the spark-arresters would serve as preliminary coolers and washers. It is a fact, however, that the efficiency of the spark-arresters at present is such that the Ford Company considers these meet the immedate requirements of the Clean Air Act.

Each spark-arrester was completely shotblasted internally before erection and given a special protective coating against the corrosive effect of water and the gases. Water from the spark-arresters is discharged into the main sluice-system used for general dust disposal (about which, more later). The sluices are carried, first on the roof of the building and then, descending, the water and sediment passes *via* a sluice-tower into settling ponds, after first passing through one of the sedimentation tanks (Fig. 6).

Neither the shell nor the lining of the cupola is tapered. A quite novel feature of the furnace construction is the use of hydraulically operated drop-bottom doors. The conventional door prop is thus dispensed with and replaced by remote control of valves in the hydraulic system, which are locked during the period of operation of the furnace. When the cupola doors are dropped, all the remaining furnace burden falls on to the ground floor, 14 ft. below the foundry floor level, from whence it is removed—after water quenching—by means of an hydraulic shovel into an adjacent road vehicle for conveyance to the dump.

A typical cupola charge consists of 5,000 lb. of metal, 550 lb. coke and 170 lb. of limestone. The four drop-bottom bucket mechanical chargers employed inclined tracks of roughly S-shape (when viewed from the side), *i.e.*, they begin and end at a less-steep inclination than the main run. Each charge bucket running on the tracks terminates at the cupola-charge opening, 48 ft. 8 in. above the rest position. At the base of each charger, the bucket comes to rest in a horizontal position underneath a metal-charge weighing machine, suspended from the general charging platform. These weighing machines incorporate a number of unique features; they are of an electrical type, using "load-cells" which are giving good service under severe shock-loading conditions. Each charge bucket contains a central drop-bottom cone attached to a "dash-pot" to counteract the impact of this core bottom when delivering the charge materials inside the cupola. Also incorporated in each charger is an automatic coke and limestone weigher with vibrating feeders extending from the storage hopper. The arrangement is such that coke and limestone are automatically weighed into the charge bucket direct from the overhead storage hoppers.

An automatic cycle for charging (at the rate of 15 charges per hr.) is initiated by dropping the metal charge into the charge bucket from its weigh-hopper, the bucket is then hoisted to a position underneath the coke and limestone weigher, at which point it automatically stops until these materials have been added. It then continues up the incline into the cupola where the bucket strikes a pad built into the rear of the cupola wall, the impact of which serves to release the drop-bottom core and the contents fall into the cupola. Afer a pause, the charge bucket returns to ground level, where the core is automatically closed and latched. In addition to weigh dials on the cupola charge-platform, charge weights are automatically recorded.

Each cupola-charging opening is covered by a steel-chain curtain which is automatically raised and lowered before the charge bucket enters the furnace and after it emerges from the cupola. These curtains serve to reduce the transfer of radiant heat from the cupola to the hoisting-unit structure and steel cables. Cupola lower sections are constructed of 1-in. steel plate and are cooled by a water curtain sprayed on to the outside of the shell beginning at a height of 14-ft. above the baseplate. To assist in cooling, the whole bottom-section of each cupola is of an all-welded construction, with joints

FIG. 13.—*Hot-gas entry points at the base of the two Lennox sand-drying columns.*

ground flush, the surfaces being subsequently shot-blasted and sprayed with aluminium metal as a precaution against corrosion.

Cupola Construction

It is interesting to record, bearing in mind the development work carried out by the Ford Motor Company, that the cupolas are of a "well-less" design, the metal being taken away continuously by a modified Freier-Grunder tapping system, which also incorporates a slag weir. There are 12 tuyeres, of round section, in a single row, constructed of 10-in. bore steel plate and welded to the shell, their centreline being only 4 ft. 5 in. above the baseplate. They are not cooled in any way. The spray cooling of the furnace shell is at present effected from a ring pipe equipped with nozzles, but it is likely that a modification of this system will soon be adopted using an annular trough and rubber gaskets in loose contact with the cupola shell. At the base, the cooling water is collected in a trough and taken, with other waste water, to the settling tanks and ponds. Slag is continuously granulated as it leaves the weir by leading it into a water sluice which carries it away to the central underground sluice for ultimate disposal with the other waste water in the settling tanks. It is understood that the sedimentation tanks (Fig. 6), which receive sludge, etc. also, from all the dust-extraction installations in the works, need to be emptied and cleared at approximately half-weekly intervals. Naturally, while one half of the sedimentation tank is being drained and cleared, the other half is in use.

Hot-blast Units

The two hot-blast recuperator units, one to each pair of cupolas, are each designed to furnish 16,000 cub. ft. per min. of air heated to approximately 500 deg. C. and are thus the largest so far supplied to hot-blast cupolas in this country. They contain horizontal cast ribbed tubes (Fig. 10) having a special welded construction at the end of the tube banks, so that they remain air-tight even at the relatively high blast pressures employed at the Ford plant—2½ lb. per sq. in. at the tuyeres! Shot-cleaning equipment is employed for the continuous scouring of the recuperator tubes.

During the running of a cupola, waste gases are extracted from above the melting zone and burned in a separate combustion chamber to provide heat to the recuperator, but for pre-heating purposes, a large "Gako" coke-oven gas burner is provided in each combustion chamber, this burner being fitted with automatic flame-failure safeguards. The fan drawing the hot gases through the system is driven by a 150 h.p. motor. Each hot-blast installation is controlled from a central instrument and control panel (Fig. 11) (one for each pair of furnaces) housing all the necessary indicators and recorders for temperature, draught, wind-belt pressure and air flow.

The air blast volume is automatically controlled by "air/weight" equipment, while the temperatures of the hot blast and of the gases entering the recuperator and flowing outside the tubes, are also controlled automatically by thermostats. All piping carrying hot gases is lagged, of course, as are all valves. Those of the latter which are used during normal operation of the plant are controlled remotely from push-buttons and position indicators on the panel, which also houses indicator lamps and a recorder, showing the height of the charges in the cupola. The waste gases from the recuperator ultimately pass to a cone-type gas washer.

The total weight of the hot-blast units is approximately 250 tons each, plus 200 tons each for the cupolas, this indicating the considerable load borne by the general construction of the building.

In the shaft of each cupola there are three take-off points for "rich gas," leading to a common duct for each pair of furnaces, where the gases go through a preliminary dust-separation "leg" and then to the combustion chamber where the necessary combustion air is admitted at the burner. Blast for each cupola is supplied first to the interior of the recuperator tubes from a centrifugal fan (one for each furnace but interconnected in

pairs) at the rate of 16,000 cub. ft. per min. (at 2½ lb. pressure) driven by a 275-h.p. motor. The cupola blower fans and motors are located in the two blowing houses at ground-floor level.

In the initial preparation of the cupola, several layers of sand are built up above the drop-bottom doors to a level just below the tuyeres and the lighting of the cupolas is effected by first charging about 6,000 lb. of coke which is ignited by gas torch through the tuyere doors. The pre-heating burners in the recuperators are only needed for about two hours at the start of each week's melting campaign.

Molten-metal System

Metal from the automatic tapping spout of the cupola in use is led by crossed launders—with stop-off gates—to one or other of four 8-tons capacity hot-metal receivers (Fig. 12). The objective of this launder arrangement is to permit metal from any one of a pair of furnaces to run into any one of a pair of receivers. The receivers have U-shaped bodies of steel plate and are gas heated; they are lined with refractory bricks and have a layer of heat-insulating bricks next to the casing. Each is electrically tilted for discharge—there being also manual gear for use in an emergency. Limit stops are arranged to prevent overtipping. The heating gas flame is reduced to a minimum once operation of the receivers has commenced.

Pouring

Molten metal is supplied to the pouring stations on each of the two main moulding and pouring conveyor systems (about which, more later) by barrel-type ladles of 2,000-lb. capacity carried on overhead runways of approximately 700 ft. total length and supported by electrically-operated wire rope hoists of 2 tons safe-working-load. The pouring track is electrified and carries ten of these hoist units, each being traversed along the track by special tractor units. Incorporated in the pouring runway are six air-operated sliding-type track-switches which permit transfer of the tractor and hoist units to different parts of the pouring tracks (the shape of the pouring runways may be appreciated by reference to Figs. 8 and 26).

Each tractor unit incorporates a rubber-tyred drive-wheel which engages the underside of the monorail. At each of the two pouring stations on the mould conveyors there is an overhead chain-type conveyor, 60-ft. long, running parallel with the pouring conveyor at a distance of about 6-in. above it. It is electrically driven by direct current through a gearbox and is electrically linked to the mould conveyor and synchronized with it. The tractor units have two-speed travel movement along the track—fast-travel for clear runs and slow-travel when approaching a pouring or metal-reception point. On approaching a pouring station at the mould conveyors the ladleman first aligns the pouring spout of his ladle with the downgate cup on a mould and then, by pressing a button, he disengages the ladle tractor drive and latches the ladle suspension with the chain conveyor above it. Pouring can then be carried out with the ladle moving at exactly the same speed as the mould on the conveyor, leaving the operator free to walk behind but to concentrate all his attention on tipping the ladle. The ladles themselves were furnished to Ford general design. Metal temperatures are taken by immersion pyrometers before pouring any ladle of metal, there being set ranges of optimum temperatures for pouring different types of castings. In addition to visual dial reading of temperatures the values are recorded on an electronic recording instrument.

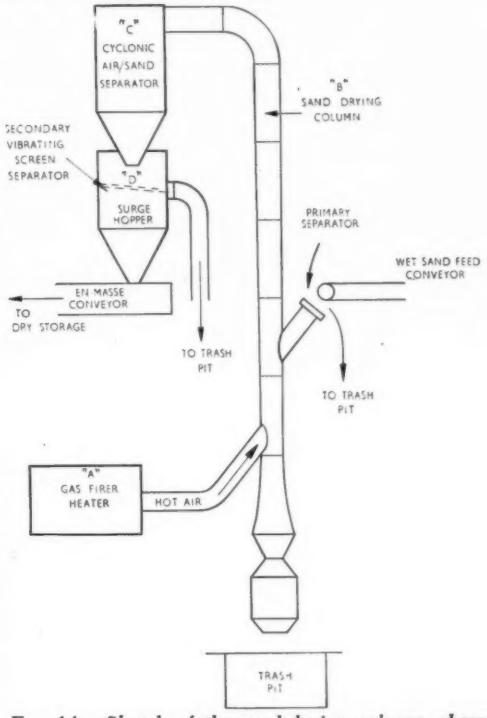


FIG. 14.—*Sketch of the sand-drying column, showing the relative position of the heater, inlet, cyclone, vibratory separator and En-masse conveyor.*

Pig-casting Machine

Surplus molten metal or any that is off-temperature or off-composition can be carried on the pouring runway to a single-strand mechanized pig-casting machine (for the location of this item, see Fig. 8). Its capacity is approximately 20 tons per hour and automatic discharge of the pig to a railway wagon is arranged and, of course, eventually the iron is returned for re-melting. A well-equipped laboratory is provided at the cupola station for metal composition checking, wedge testing, etc.

SAND PLANTS

At the outset it should be mentioned that the sand-preparation plant at Ford's Dagenham foun-

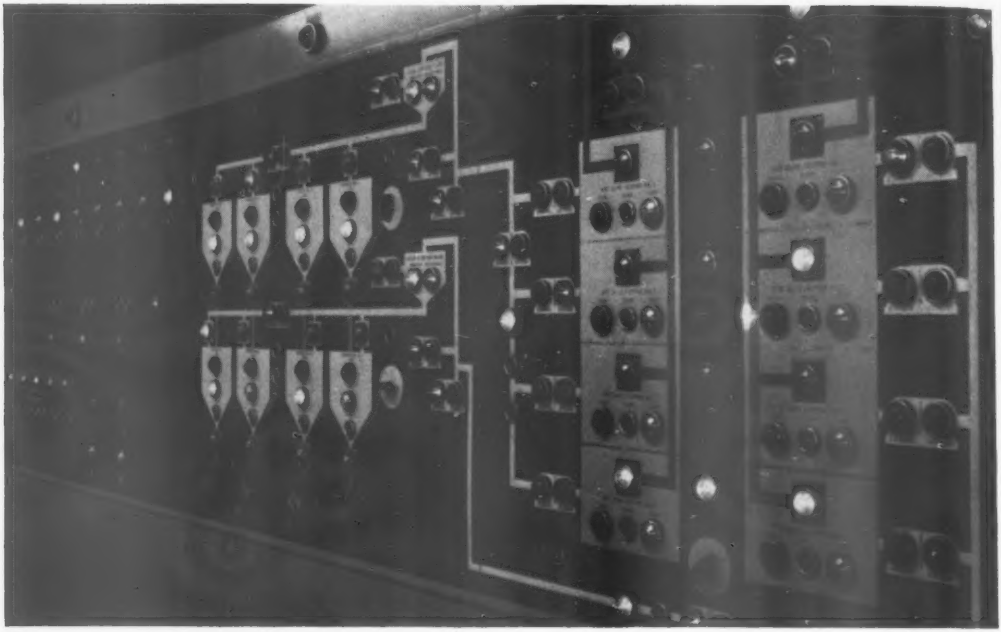


FIG. 15.—*Sand-handling control panel at the raw-sand distribution-centre in the ancillary building.*

dry has been developed in recent years so that quite a high degree of mechanization has resulted. These same principles have been applied, and still further elaborated at the Thames foundry, to give a complete installation possibly unique in the whole world in the extent to which "automatic motivation"—a phrase coined by Ford engineers and later shortened to "automation"—has been applied. The particular improvement at the Thames foundry is that (*a*) the integration of the control system for the plant has been transferred to mechanical, instead of manual, operation; (*b*) that the need of material to be delivered to the operating points is now signalled by instruments instead of being given by word of mouth, and (*c*) the sand-mixture formulae are transferred to a robot system for interpretation. Thereafter, selection and weighing-out of raw materials, their mixing at the respective stations and their delivery to the hoppers above the machines is all carried out automatically.

The installation (illustrated variously in Figs. 13 to 22) comprises: An automatic sand-drying plant, complete with sand-storage facilities and sequence-controlled equipment for handling new sand; sequence-controlled totally-enclosed conveyors for the delivery of dry sand from the sand-drying building to the coresand-preparation plant—and separately to the moulding-sand hoppers; automatic control equipment for weighing, mixing, and pneumatic delivery of mixed sand to the coremaking stations, and operational sequence control equipment for the co-ordination and integration of all activities.

The sand-drying plant at the Thames foundry is situated at the east end of the ancillary building and is divided into four sections, namely: (1) raw (wet) sand handling and storage; (2) sand-drying equipment; (3) dry-sand handling and storage, and (4) control equipment.

Wet-sand Handling and Storage

Raw sand of two main types, Aylesford for fine-grain and Garside for coarse-grain, is delivered to the siding adjacent to the ancillary building in end-tipping wagons. The raw-sand handling equipment is rated at 80 tons per hr. and consists of a 35-ton rail-wagon tipper, a vibrating feeder-grid, a 70-ft. high bucket elevating conveyor and a belt conveyor system to distribute the raw sand into the various storage bunkers according to type. These storage bunkers are arranged in two sets of four—one for raw coarse-grained and the other for raw fine-grained sand—to give a total storage capacity of 600 tons of new sand. At the outlet of each bunker, there is a 4-ft. 6-in. rotary-table feeder, which regulates the flow of sand on to one of two 16-in. wide belt conveyors, and on these sand is transported to the sand-drying columns. Before drying, however, the sand is given an initial screening to separate out lumps of slag or other foreign matter which otherwise might choke the entrance of the drying column. The feeder conveyors and rotary tables are each rated at 12½ tons of sand per hr. corresponding to the capacity of the respective driers. Simultaneous operation of more than one rotary table to each conveyor is prevented by

means of automatic cut-out equipment embodied in the plant.

Sand-drying Equipment

Two sand-drying columns, each with a nominal capacity of 12½ tons per hr. are employed. These are of the vertical thermo venturi design, approximately 18-in. dia. and 60-ft. high. Basically, the sand-drying equipment consists of a direct gas-fired air-heating unit (Fig. 13 and also shown at A, Fig. 14): a cast-iron hollow vertical drying column (B), and a cyclonic sand/air separator (C) of a special type designed to give high operational efficiency.

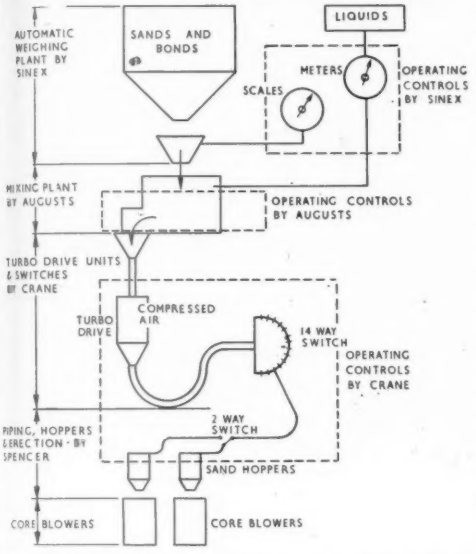


FIG. 16.—*Schematic arrangement of the automatic coresand mixing and distribution system.*

Sand enters each drier *via* the feeder conveyor, approximately one third of the way up the column, becomes entrained in the hot-air stream from the heater unit and is then drawn into the cyclone where it is separated from the air. Any large lumps which have passed through the primary separator at the entrance of the drier, but are too heavy to be airborne, fall through the air stream to the base of the column into a trash collector. After collecting in the cyclone, the sand reaches a vibrating screen with ¼-in. mesh which screens out small pebbles, etc., which have become air-borne and these are directed out of the separator also into the trash collector. After passing over the final vibrating screen, the sand is collected in a "surge hopper" (D) to the base of which is connected a totally-enclosed En-masse conveyor. This conveyor feeds the dry sand into the dry-sand bunkers. As with the wet-sand bunkers, there is a total dry-sand storage capacity of approximately 600 tons, again in four banks of hoppers all situated in the ancillary building.

Handling-plant Controls

The handling plant which feeds sand from the wagon tipper to the storage bunkers, and from the storage bunkers into the driers, is controlled for sequence operation by means of interlocking relays housed in a control panel, whilst level controllers (of the diaphragm type) in both the wet- and dry-sand storage bunkers give visual indication on the panel (Fig. 4) of both high and low levels.

The vertical sand driers are equipped with safety control-equipment, which prevents them from starting up until the feeding and collecting conveyors, serving the respective driers, are both running. Provision is made to ensure correct sequence-starting of the heating, drying and separating equipment. In the event of either gas-supply failure, compressed-air failure, power failure, or electrical or mechanical breakdown of any part of the equipment itself, there is an automatic shut-down of all items in the system. Temperature-control equipment maintains the temperature in the drying column at between 190 and 210 deg. F.—a temperature deemed necessary to effect complete drying of the sand. Gas supply to the heaters is varied automatically according to the actual tonnage of sand being fed into the drying columns and also according to the moisture content of the sand entering the plant.

Dry-sand Handling

The dry-sand delivery system conveys new sand to the coresand-preparation plant and also to the new-sand additions bunkers for the moulding lines. It consists of four En-masse elevating conveyors and 14 En-masse totally-enclosed horizontal conveyors.

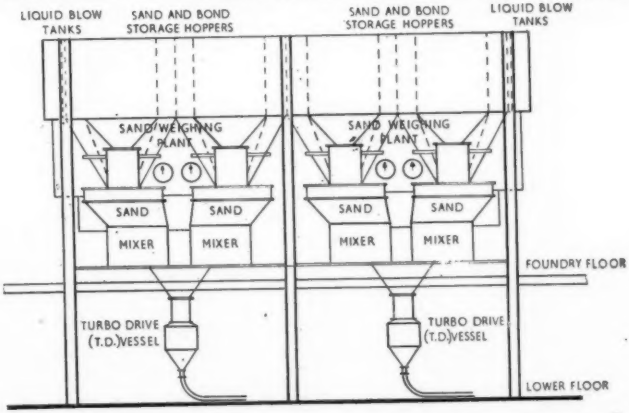


FIG. 17.—*Diagrammatic layout of the coresand preparation plant.*

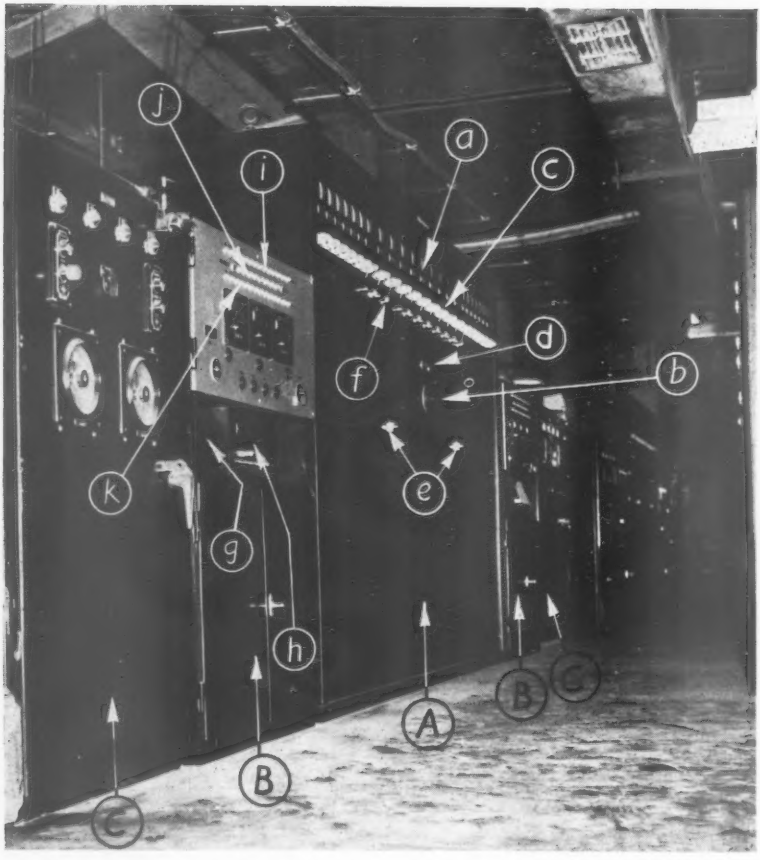


FIG. 18.—*Layout of the control panels for the coresand mixing plant.*

KEY: A. Turbo-drive control panel; B. sand-weighing control panels (left and right hand); C. mixer control panels (left and right); (*a*) signal lights; (*b*) rotary selector; (*c*) station lights; (*d*) operating buttons; (*e*) pressure-vessel lights; (*f*) memory lights; (*g*) formula-card storage; (*h*) card reader drawer; (*i*) formula lights; (*j*) progress lights, and (*k*) "in mixer" lights.

The elevating conveyors each have a total lift of approximately 60 ft., whilst the delivery conveyors transport new sand a distance (including the crossing of the east gallery to the main building) of 660 ft., to the coresand-preparation plant or, alternatively, 650 ft. to the new-sand hoppers adjacent to the moulding lines. To alter the destination of the sand from core- to moulding-sand hoppers, there is a changeover switch at the T-junction where the En-masse conveyors—arranged in series for taking sand across the gallery—divide, left for the moulding lines or right for the dry coresand hoppers.

Dry sand delivered to the coresand preparation station is stored in bunkers similar to those used in the sand-drying building, these bunkers having a storage capacity of 150 tons. These secondary dry-sand storage bunkers (of which more later) are also equipped with automatic level-controllers indicating the appropriate sand levels on the control panel in the sand-drying building.

Control Equipment

All control for sand drying and delivery is carried out by electrical equipment (Fig. 15) which is housed in the sand-drying section of the ancillary building. This equipment is in two parts: (1) The centralized sequence-controls, contactors, starters, relays, etc., for all the equipment involved, and (2) a "Mimic" panel giving to the control supervisor the necessary visual indications of the demands made on the plant, enabling him to carry out his functions directly from a diagrammatic arrangement of the plant under his control.

As stated, all conveyors are sequence controlled for starting up and shut down (the latter being automatic in the event of electrical or mechanical failure) and they are also time controlled to permit adequate purging between periods of use. This purging has been included in the installation to avoid contamination, in view of the large quantity of sand that could be in transit at any one time in the En-masse conveyors. It enables the respective sections of the system to be cleared of one type of sand (for example, coarse-grain, fine-grain, coreshop or moulding lines) before the next type is placed in transit.

Coresand Preparation and Distribution

The coresand requirements of the new foundry are very considerable (of the order of 20 tons per hr.) and since much of the accuracy of the finished castings is bound up with the quality of cores delivered to the moulding station, there is no more important section than that devoted to coresand preparation and coremaking. In many respects the elaborate plant now installed for these purposes is unique and is therefore dealt with in great detail in the account which follows.

In common with other advanced trends of thought in foundry sand-preparation, the design

staff of the Ford works have long realized that human failings had to be eliminated from the control of processes if the requirements of product quality, flexibility and economic operation were to be met in the Thames foundry. The installation, therefore, was laid out to meet these requirements and, at the same time, to couple automatic indication of the shop-floor sand needs with selective preparation and distribution of coresand. The sand-preparation and distribution plant (Fig. 16) consists of five main elements, namely:—(1) bunkers for sand and for dry binders and tanks for storing liquid bonding materials; (2) sand-weighing, bond-weighing and liquid-metering equipment; (3) sand-mixing equipment; (4) pneumatic conveying equipment for taking the sand to the coreblower hoppers, and (5) indication and control panels for the operation, control and integration of all functions of the installation.

Sand and Bonding-material Storage

In the main building, adjacent to the coresand mixing stations, sand and binding materials are stored in four groups of bunkers—one group being allocated to each of four sand mixers (these are models 2F). Each group of storage bunkers has five compartments, one for each of the two types of sand, and one each for the three types of bonding materials. Sand is delivered to the bunkers by the En-masse conveyor system from the sand-drying plant mentioned earlier; the dry bonding materials are conveyed to their respective storage bunkers by means of an En-masse self-purging flight conveyor from the bond stores—located beneath the mixing station—and the liquids (linseed oil, Permol and water) are piped from the central oil stores or taken from water mains into separate storage tanks, which are adjacent to the sand-mixing plant.

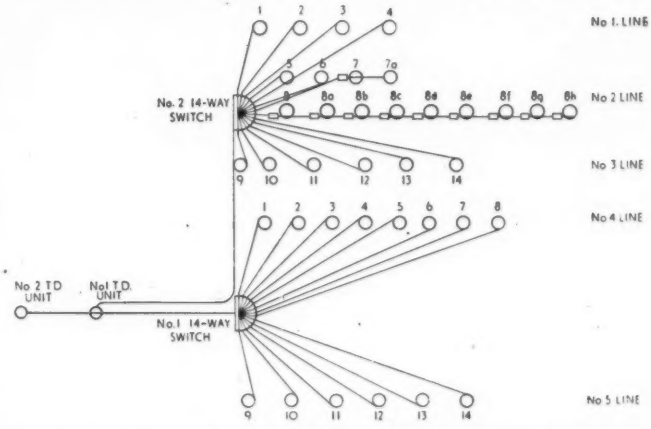


FIG. 19.—*Diagrammatic layout of the coresand automatic-distribution system, showing the coreblower stations served by the two 14-way pipe switches.*

Each bunker is equipped with high- and low-level contents indicators which signal their requirements automatically direct to the sand-drying plant and bond stores respectively. As a safety precaution against spontaneous explosion, each bond-storage bunker is fitted with automatic explosion-suppression equipment.

Sand Weighing and Liquid Metering

Referring to the diagrammatic arrangement of one of the four sand-weighing plants shown in Fig. 17, the sands and bonds are fed by means of electro-vibrating feeders into weigh-hoppers, and liquids are measured through metering pumps into small pressure-tanks. After weighing and metering, these are held until the mixer is ready to receive them.

Punched-card Mixing

One of the most interesting features of the whole plant is the use of the "punched-card" principle, using plastic formula-plates at a master control station (Fig. 18) for the selection, weighing and metering of the ingredients for the various coresand mixture formulæ. This method works on the following principle: The operator selects the respective "punched-card" formula-plate, places it in the "formula-reader" section (drawer) of the control panel and depresses the operating button. From here, the weighing and metering of all materials is automatic. The perforated formula-plate controls the correct selection and quantities of the various ingredients by means of impulses fed to the electro-sensitive equipment actuating the vibrators, metering pumps and weigh-scales. Additions to the weigh-hopper are first made at a rapid rate until the load approaches within about 5 per cent. of that desired, when a slow feed takes over until the required total ingredient weight is reached. Flexibility is infinite—the number of different formulæ depending on the number of plates kept. By either modifying the existing plate or punching a new one on the spot to interpret the percentage mixture laid down by the foundry sand laboratory, changes can be made to any formula both accurately and speedily.

Coresand Conveying

At the Thames works, four batch-type sand mixers, each of 2,000-lb. capacity, are employed; each operates on a nominal 6-min. mixing cycle which is automatic after initiation. The cycle, which commences with the discharge of the previously weighed and metered sand, bonding materials and liquids into the mixer, controls the period necessary for mixing the ingredients and then ejects the prepared sand into the pressure vessel of the pneumatic

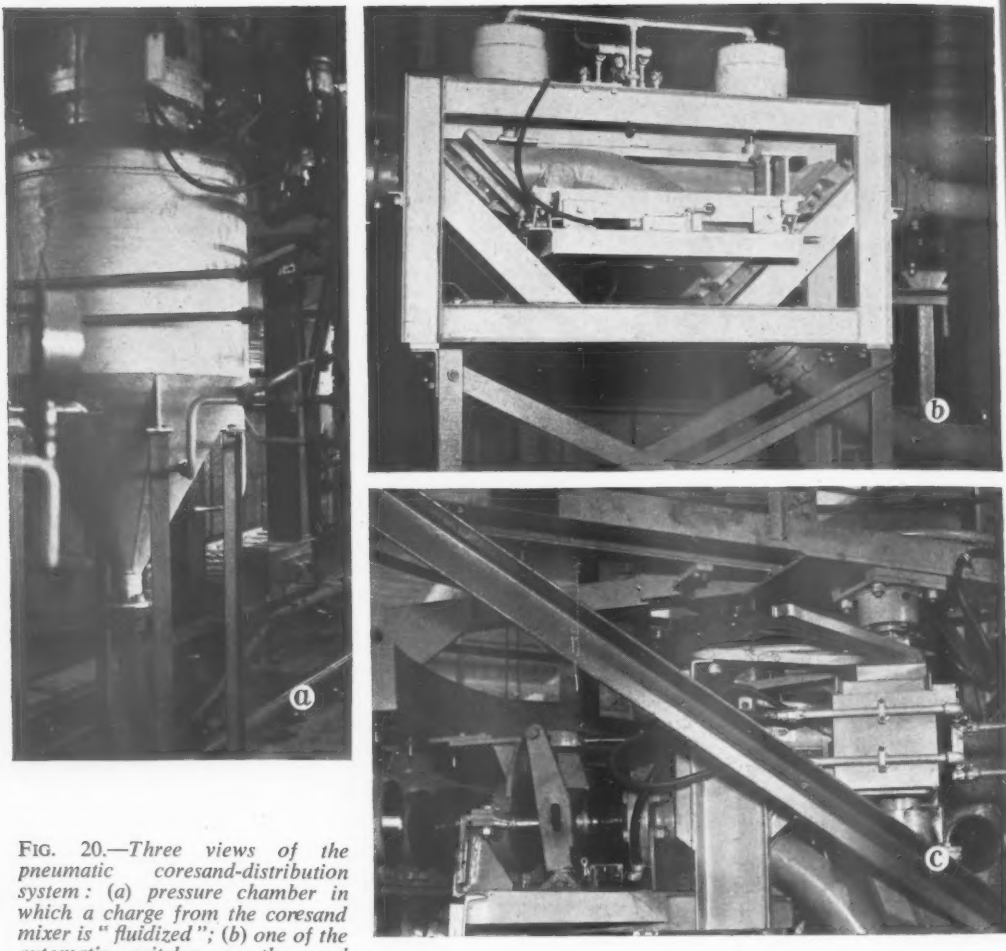


FIG. 20.—*Three views of the pneumatic coresand-distribution system: (a) pressure chamber in which a charge from the coresand mixer is "fluidized"; (b) one of the automatic switches on the sand distribution pipe-line, and (c) part of a multi-point transfer switch.*

conveying plant, located on the lower floor immediately beneath the mixers.

This is a highly elaborate distribution system, a diagram of which is shown in Fig. 19. Two of these plants have been installed in the Thames Foundry, one having 23 receiving stations and the other, 14. In each plant, there is a pressure vessel or "turbo-drive" (t-d) unit, a number of 4-in. dia. steel delivery pipes through which the mixed sand is delivered to the individual coreblower machine hoppers, a 14-station transfer switch (Fig. 20) to enable the sand to be directed to the selected core-making station, a sand-receiving hopper at each station, and a control panel. When the mixed coresand has been ejected from the sand mixer into the t-d vessel, visual (light) indication on the control panel permits the operator to select the station requiring sand and by push-button to initiate the conveying cycle to deliver the material to that machine. When this is done, the gate on the t-d vessel closes, compressed air (in the region of 40 to 60 lb. per sq. in.) enters the vessel and the batch of mixed sand is delivered pneumatically to the receiving hopper, located vertically, above the coreblowing machine.

Indicating and Control Panels

There are two combined indicating and control panels—one for each pneumatic conveying plant. Incorporated in each panel are (*a*) two sand-weighing panels, (*b*) two sand-mixer control panels, and (*c*) a central distribution panel for controlling the pneumatic conveying plant. These five individual

units are electrically interlocked for sequence control and all the controls for the sand-preparation plant are accommodated in a control room at the sand-mixing station.

Coresand Operational Cycle

To enable readers to follow the operation of the complete coresand mixing and distribution installation, the following step-by-step operational cycle is detailed, imagining that one is standing at the control panel shown in Fig. 18.

At the centre of the panel is the turbo-drive control unit and the bin-level indicators are represented by a number of white signal-lights along the top, numbered 1, 2, 3, etc., thus representing the receiving hoppers of the various coremaking stations. A mask embodying a letter of the alphabet (A, B, C, etc.) covers each particular light and this letter indicates the type of sand mixture employed at that coremaking station at that particular time of operation of the plant. If it is decided to change a mixture at a given machine, the appropriate letter change is made over the light and the punched-card bearing that letter is used to produce the requisite sand mix. When sand is required at one or more of the coremaking stations, a signal is given by the corresponding light on the t-d panel being illuminated. This gives an indication of "when," "where" and "what" mixture is required. Suppose, for example, that formula "B" is being used at station No. 2 and that a low level has been reached in the machine receiving hopper. Signal light No. 2 lights up and the operator selects the punched formula-plate corresponding to formula "B" from the storage rack, inserts the plate into the formula-plate reader and closes the drawer. At this point, reference must be made to the sand-weighing control panel where there are three rows of lights. The top row is marked "Formula Selected," the middle row is of ten lights, one "red" marked "In Progress," one "green" marked "Weigh Complete," and eight "White" lights for individual ingredients. The bottom row of white "Memory Lights" is identical to the top row, but marked "In Mixer."

After inserting the formula-plate "B" in the reader and closing the drawer, light "B" in the top row lights up to confirm the correct formula selection. Depression of the operating button locks the "punched card" drawer in position, initiates the weighing and metering operations, and selects the delay relay for the "Memory Light." During the metering and weighing, the red light "In Progress" is illuminated and on completion of the operation, the green light "Weigh Complete" indicates to the operator that the correct quantity of all the ingredients are held awaiting discharge into the sand mixer. Attention must next be given to the sand-mixer control panel, where depression of the operating control button discharges all the ingredients into the mixer, initiates the mixing cycle and finally ejects the prepared sand into the t-d vessel of the pneumatic transporter. When the discharge door of the mixer opens to eject the sand into the t-d vessel, the memory-light delay relay-circuit on the t-d panel is completed and the memory light (corresponding in this particular example to formula "B") light up. The selection of the delivery point is then carried out on the t-d control panel. By referring to the photograph of the panel (Fig. 18), it will be seen that there is a rotary selector

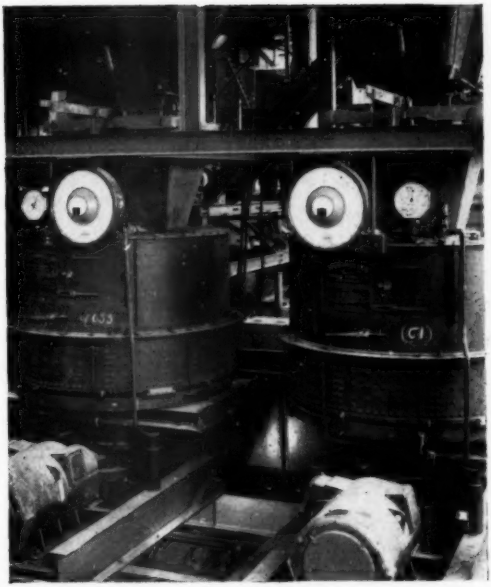
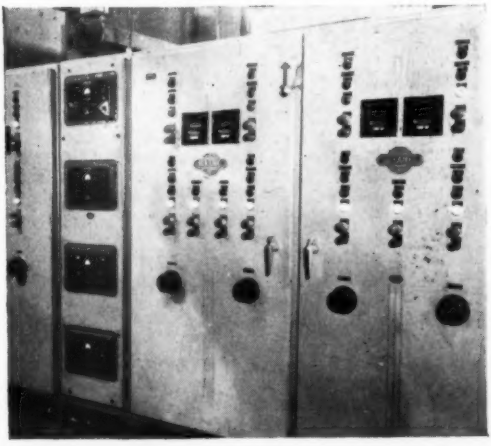


FIG. 21.—*Two of the "Speedmullers" used for moulding-sand preparation. Note the weigh dials on the batch hoppers and the water-meter dials.*

FIG. 22.—*One half of the control panel for the coal-dust/Fulbond-slurry mixing plant, located in the ancillary building. Explosion-suppression indicators are shown on the left. The main panels are in fact duplicated on the left-hand side of the explosion-suppression indicator section.*



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with 14 stations, each corresponding to a particular coremaking station. By turning the rotary selector (in this example to No. 2), the multi-station rotary transfer switch is actuated and a white "station-light" below the white "signal-light" on the t-d panel, corresponding to station No. 2, lights up, proving that the station selection is complete.

Also on the t-d panel are two "pressure-vessel lights" (one green and one red) and a pushbutton and two rows of memory lights. The green indicator lights up when a batch of sand has been ejected from the mixer into the t-d vessel—the red light is illuminated when the t-d vessel is under pressure, conveying sand. The operator thus has the following information "at his finger-tips": (*a*) A knowledge of "where," "when" and "what" sand formula is required (indicated by the white signal-light); (*b*) a knowledge of "what" formula has been prepared (indicated by the "memory light"); (*c*) station selection complete (shown by the white "station-light"), and (*d*) t-d vessel available to take the prepared mix (indicated by the green "pressure-vessel light").

Depression of the t-d pushbutton initiates the operating cycle which first closes the t-d vessel gate, and admits compressed air to the t-d vessel to deliver the sand to the selected station. All the lights which refer to station No. 2 and formula "B" in the example quoted now automatically cancel on completion of the conveying cycle and the net result is that 2,000 lb. of sand to formula "B" will have been delivered into the machine hopper at station No. 2.

Time Occupied

The three basic processes of weighing, mixing and transporting a batch of coresand take a total time of about 10 min. to complete for one formula. However, it is possible that three different formulae can be progressed at the same time—one being weighed, one mixed and the other in the conveying plant. The longest individual process is mixing, which takes approximately 6 min. and this time governs the capacity of the plant. To prevent overlapping of the processes and to ensure complete sequence control, use is made of electrical and pneumatic interlocks in the control circuits.

Each individual coremaking station automatically signals its requirements at least 10 min. in advance of the actual need, this being accomplished by means of the level controllers in the mixed-sand receiving hoppers, one above each coremachine. These controllers are set at a level corresponding to 15 min. reserve use (10 min. plus 5-min. contingency allowance).

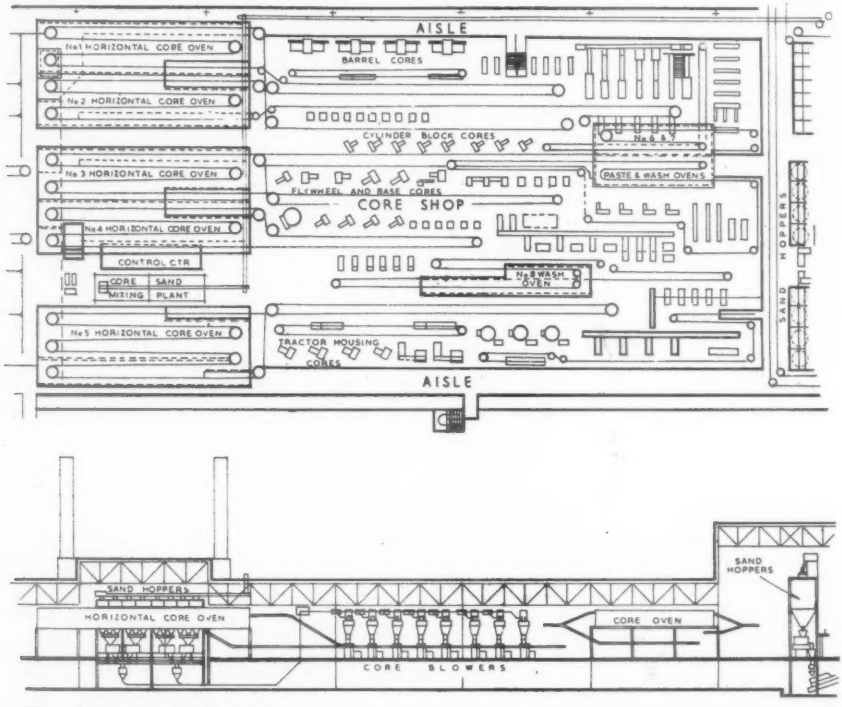

FIG. 23.—*Detail plan of the coremaking and coredrying sections of the foundry.*

It will be obvious to readers that this new installation eliminates all manual operations from core-sand mixing and distribution (only two pushbutton supervisors being required) and that quality control is provided through every phase of activity by the automatic control of processes. It is true to say that from the time the raw materials are received at the ancillary building until the mixture is delivered to any of 37 coremaking stations, these materials are unseen and not touched by hand.

Moulding-sand Systems

It will be remembered that when considering the new-sand systems at the Thames Foundry earlier in this section, the treatment and routing were described up to the stage of delivery of dried sand, both for coremaking and for moulding, at the batteries of storage hoppers in the main building. At this point, it is convenient to consider the moulding-sand plant as a whole, and to include in the account the introduction of new sand from the dry-sand hoppers adjacent to the moulding section, and also the preparation of a coal-dust/Fulbond/water slurry for addition at the mullers.

Speedmullers

The whole sand-circulation system for each moulding line is based on the circulation of approximately 200 tons of sand per hr. and for actual sand milling in the treatment plant for each of the two moulding lines, there is a battery of four model 80 A Speedmullers (Fig. 21). Automatic operation of these is arranged on a pre-set rota; each treats approximately 1 ton of sand per batch on a 70-sec. cycle.

FIG. 24.—*One of the core-storage and -transporting racks. Note the spring-loaded hinged shelves.*

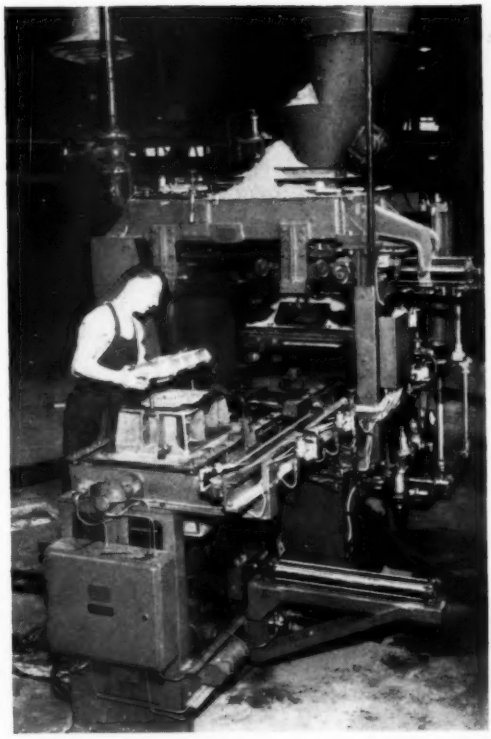

FIG. 25.—*Osborn coreblower combined with a rollover/stripping device.*

Above each group of the four Speedmullers is a 250-ton capacity storage hopper for used sand; from these hoppers batches are withdrawn in sequence and weighed in a weigh-hopper before being discharged into the muller. After treatment, the sand is discharged for delivery to the individual hoppers (each of 5-ton capacity) serving the relative eight moulding machines. As stated, operations in the mullers are automatically controlled; the following sequence applies: (*a*) Water additions to the pan; (*b*) flush period of a few seconds to free any sand from the bottom of the pan (this is most important); (*c*) sand is admitted; (*d*) bond slurry (about which, more later) is added to the amount of approximately 2 gall.; (*e*) mulling cycle 35 to 40 sec.; (*f*) discharge, and (*g*) during the mulling period, a second batch is weighed. The slurry addition at the mullers is comprised of water, coal-dust and Fulbond, mixed in the slurry plant to a consistency of about 35 to 40 per cent. solids (which is about the maximum the water will take and still permit the whole to flow).

The water additions are pre-set at the water meter and the slurry entry is likewise controlled on the basis of the final sand moisture required. The test properties for the moulding sand as delivered

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at the machine stations range between: moisture, 3.0 per cent. to 3.2 per cent.; "green" permeability, No. 90 to 100; green compression, 12.0 to 13.5 lb. per sq. in.; flowability, 50 to 56. When jolted and squeezed by the moulding machines, this sand is expected to give a mould-hardness value of about 70 to 75 on vertical and 80 to 88 on horizontal faces.

The batteries of mullers are started up at various times to suit the sand demand and thereafter, their operation is repetitive and continuous; control can be either by hand, single-batch automatic or repeat auto, whichever is desired.

Stainless-clad Hoppers

The moulding-sand hoppers serving the machines are constructed of stainless-clad steel and designed with a fairly steep angle. This seems very effectively to cure the bugbear of sand sticking in hoppers, though it is not a cheap method of construction.

Return sand, strike-off excess sand from the machines, general sand spillage, sand from the shakeout grids, excess sand from the mullers—together with new sand bled into the system from the 55-tons total in the hoppers mentioned previously—is all returned to the main sand-storage hoppers above the mullers, this being effected by a series of belt conveyors. On the way, the sand

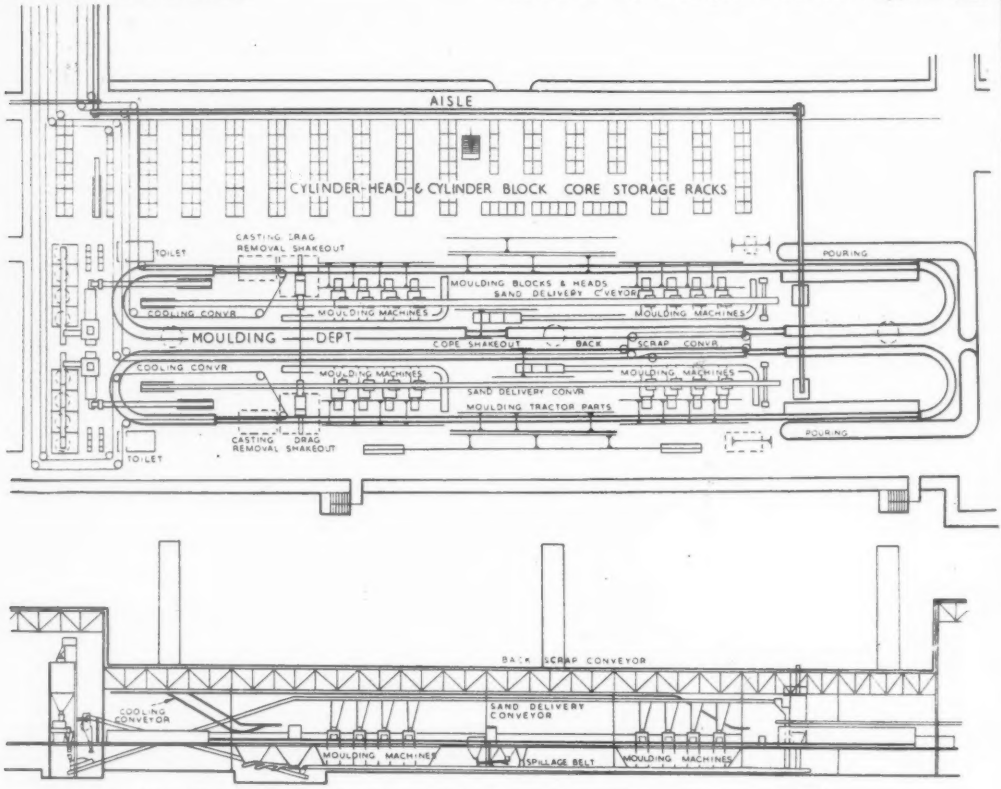

FIG. 26.—*Detail plan of the coreplacing and moulding sections of the foundry.*

Sand is discharged from the mullers on to a belt conveyor, through an aerator and on to the distribution belt for elevation and delivery to the moulding-machine hoppers. On reaching these, sand is ploughed off to the individual machines according to demand—the demand being registered by two diaphragm-type level controllers, one near the top of the hopper and one about three-quarters down the inside. The ploughs on the belt are pneumatically operated by these electrical level-controllers.

passes through a rotary cooler screen, 6 ft. dia. by approximately 25 ft. long. This is capable of dealing with 200 tons of sand per hr.—the same capacity as the bucket elevator which next takes the sand to the storage hoppers. In the same system, just before the sand enters the rotary cooler/screen, there is a magnetic head-pulley on the belt and a magnetic Overband unit to extract tramp metal (or "trash," as it is termed at Ford's) from the sand. The trash goes to a single refuse belt (serving both

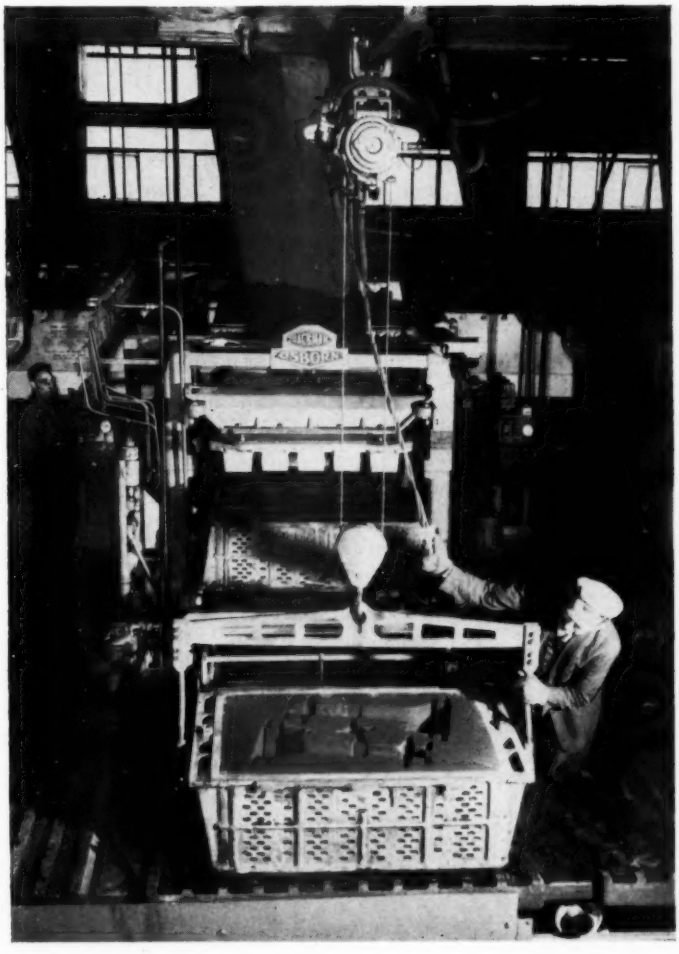

FIG. 27.—*One of the Osborn/Jackman moulding-machine stations. The operator is placing a drag half-mould on the pallet mould conveyor. Note the sand hopper above the machine; the operator at the controls (left) has another half-mould on the machine ready for turning over.*

sand systems) which directs the metal to the return-scrap handling-plant.

Core lumps, and any pieces of metal which escape the magnet, are sorted out in the rotary cooler/screen. The latter is of duplex construction, with one cylinder of 4 in. by 1 in. mesh steel on the inside and another cylinder of ½-in. mesh material outside it. Thus, large lumps are rejected at the centre, smaller ones between the two cylinders and usable material passes the ½-in. mesh.

Slurry Plant

Several earlier references have been made to the existence of the slurry plant and it will have become obvious that its purpose is to pre-mix coal-dust, bonding clay (Fulbond) and water for addition to the moulding sand at the Speedmullers.

The slurry obviates the need for any dry additions to be made at the mullers. The plant is situated in the east end of the ancillary building, and slurry is piped to the moulding system *via* a 2-in. ring-main, where it is metered into the Speedmullers in predetermined quantities. There is no doubt that adding the materials in this way confers better properties on the sand.

Two slurry-preparation plants have been installed, one for each moulding line; their capacity is such as to produce batch mixes of 300 gall. per plant in 20 min.

The "Fulbond" in powder form is received by road in specially-designed bulk containers from which it is pneumatically transferred into one or more of four storage hoppers of 24 tons capacity each. Coal-dust arrives in portable metal containers of 17 cwt. capacity each, which are lifted by an electric hoist and runway to discharge into the top of the coal-dust storage hoppers *via* specially-designed spring-loaded entry valves. These four hoppers hold 60 tons each. To guard against explosion hazards these hoppers are fitted with special explosion-suppression devices. Coal-dust and the clay are then fed separately through rotary valves on to a conveyor and thence into mixing tanks—one for each system—the required amount of water being added at the same time. Mixing takes place by mechanical agitation and the resultant slurry is pumped through the slurry *via* ring-main to the Speedmullers, any excess being returned into 500-gall. storage tanks by means of selective valves. When the mixing tank is empty, feed from the storage tanks can be arranged into the ring-main while a batch mix is being prepared. The storage tank likewise is equipped with a mechanical agitator to prevent sedimentation.

The main control centre for this plant (Fig. 22)—from which distribution of the slurry also is arranged—accommodates automatic counting devices which dispense the correct amounts of materials through valves into the mixing tank. Water is also metered automatically, the whole

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permitting such a nice degree of accuracy that slurry consistency is controlled to within 1 per cent.

COREMAKING AND COREDRYING

As is indicated in the preceding section and is well known to foundrymen, successful production of automobile castings is dependent on high-quality core-production. Thus, as would be expected, the highly-elaborate arrangements at Thames Foundry for producing and distributing coresand of uniformly excellent quality have their counterpart in the core-production, core-baking, core-assembly and core-distribution sections. These are housed in an area 340-ft. long by 180-ft. wide between the coresand mixers and the moulding lines (see Fig. 1 for general layout). Relative positions of various types of plant may be appreciated from the detail plan and elevation drawings of this section, shown in Fig. 23.

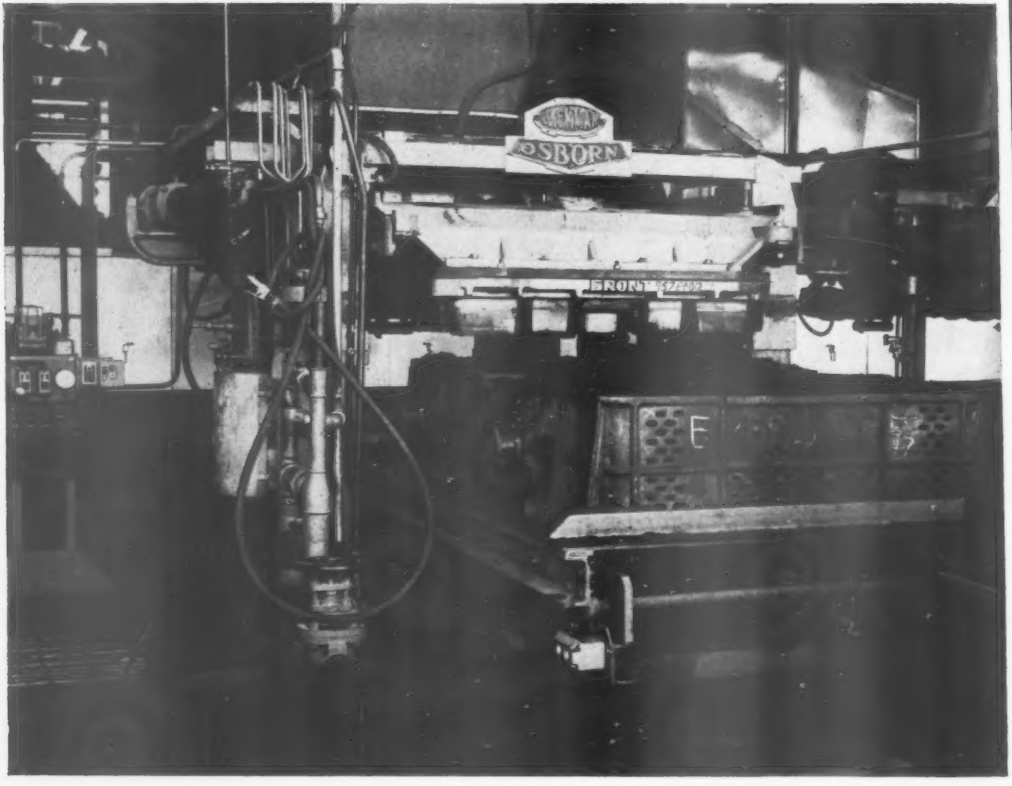
The centralized coresand preparation station with arrangements for pneumatic distribution to each of the coreblowing machines has been dealt with in the preceding section. In what follows, the various coreblower production lines will first be described and then the drying ovens. It must be appreciated at the outset, however, that all coreblowers are served by the overhead chain/pendulum conveyors taking cores to ovens and afterwards to dipping stations and core-assembly areas.

Core Production

No. 1 Line:

The first core-production line (for which the conveyor cycle is 2 hr. 36 min.) is engaged on producing cylinder block and barrel (combined cylinder bore and crankcase) cores. These are obtained from a battery of four model F.E. 300 coreblowers which have a central blow-head and a rollover/strip station on either side. The platen size being 18-in square. All coreboxes used for barrel cores have common outside dimensions of 15 by 13 in. overall, but are of varying heights according to what can be accommodated on the various machines. From these machines, 100 to

FIG. 28.—*One of the cope moulding-machines. Here a second cope half-mould has just been squeezed and the half-mould already on the run-out rollers is awaiting removal for closing over a drag half, which is already waiting on the mould conveyor.*



120 cores per hr. are expected, typical cores being the 100E pattern, which weighs 25 lb., whilst others weigh up to 45 lb. After blowing and stripping on to coreplates they are loaded on to conveyor trays taking them first into a dip tank containing plumbago wash and are then transferred to the core-oven conveyor carriers. After baking, cooling, dressing, the barrel cores are placed in transportable racks (Fig. 24) for delivery to the moulding line by fork-lift trucks.

Hinged-shelf Racks

Here it is worth noting that there are about 400 of these transportable core racks employed in the Thames Foundry. A special feature of a number of them (clearly shown in Fig. 24) is the hinge mounting and spring-loading of the shelves, so that as cores are removed from the higher shelves, these shelves can be released to hinge upwards and so permit easy access to the next lower shelf. It is remarkable how much of a print area at the base of a core can be removed by dragging it along a coretray—sufficient sometimes to impair the accuracy of a casting! The use of the hinged shelves goes a long way towards obviating this source of trouble. The racks can be stacked one above the other, if required.

No. 2 Line:

On the second core-production line, eight automatic coreblower/rollover/stripper machines are installed; these are O/J. models with F.E. strippers (Fig. 25). On these, the cycle is to blow—transfer to a rollover device—clamp (using a plate or dryer) —rollover—strip—push out, and lift up to the operator; 100 cores are expected per hr. per machine. Also on this line are six bench-type coreblowers and two coreshooters. This line specializes in making water-jacket cores and there is no automatic dip, the production going straight through the oven. After baking and cooling, cores from this section are dressed, hand dipped or pasted together into assemblies and then carried on a chain conveyor through a paste- and wash-drying oven. This is known as No. 6 oven and like the main core-ovens, it is elevated above the floor. The paste-drying cycle is ½-hr. at 350 deg. F.; afterwards the cores are taken from the conveyor, trimmed, inspected, and then placed on the transportable racks for delivery to the moulding line.

No. 3 Line:

On the third core-production set-up there are six O/J automatic coreblowers employing two different types of strippers. These are employed on cylinder-head base cores, flywheel-housing cores and wet-sleeve engine (truck and tractor) cylinder cores. The after-treatment is similar to that for line No. 2 and a second (No. 7) wash- paste-drying oven is employed (as a twin to No. 6).

No. 4 Line:

This is equipped with four automatic coreblower/stripping machines, model O.193, two coreshooters and two bench blowers. Eventually, a five-station Rotocore machine is to be installed here. This line produces cylinder-head cores and will also manufacture a number of smaller cores used in tractor production. The cylinder-head cores, after baking, dressing, assembly and paste-drying, are put on transportable racks designed for No. 1 moulding line and the tractor cores are placed on the pendulum carriers of the chain conveyor serving the core-setting area on No. 2 moulding line.

FIG. 29.—*One of the pouring stations on the mould conveyor. Note the slatted extraction-hood for taking away dust and fumes.*

No. 5 Line:

Core production from this line comprises four automatic coreblower/strippers of UK manufacture and two large semi-automatic coreblowers which were imported from the USA. After blowing and baking, cores from this line are dip-washed, and the wash is dried in a wash- and paste-drying oven (No. 8), which also serves the No. 4 core-production line.

The joint faces of these cores are then ground on American-made core-grinders, type R.70, and then after inspection, they are transferred to No. 2 moulding line by chain conveyor. In addition, there are six core-grinders—Ford (Dagenham) designed machines—at various locations in the core-shop, and these are used for coreprint grinding in lieu of hand rubbing.

Minor core-assembly operations are carried out on rubber-belt conveyors, and dressing of the cores required here is carried out on benches close by.

Assembly of other cores is done prior to core-setting on the moulding line in assembly jigs, and complete assemblies are placed in the respective moulds using the "iron-man" finger device which holds them clamped together until actually in position in the mould.

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The transportable racks themselves provide core-storage facilities for those cores used on No. 1 moulding line, and a set area is provided for storing some of the heavier cores required for No. 2 moulding line on the ground floor, the overhead chain conveyor in this case being used merely for service to the various areas.

Core-wash Mixing

Two types of corewash are employed, one based on plumbago and the other on chamotte. The washes are mixed in a centralized plant between No. 2 and No. 3 core ovens and distributed by ring-main to the various points of application in the coreshop.

Coreovens

Five main corebaking ovens are arranged side by side, independently supported on pillars 14-ft. above the floors at the west end of the coremaking area (see Fig. 23, layout plan and elevation of the coreshop); they are of the horizontal continuous type, UK built to US designs. The floor-space underneath the ovens is mainly employed for accommodating the heater units, recirculating fans and also for storing coreboxes and driers not in use. Two pairs of double ovens are employed, Nos. 1 and 2 and Nos. 3 and 4, each oven of these pairs being 100 ft. by 50 ft. wide; the No. 5 oven is on its own (size 100 ft. by 37 ft.). The oven heaters are direct fired with cokeoven gas and hot air recirculation through the ovens is practised. Exhaust gases from the ovens are delivered to two brick-lined headers on the roof of the building (each 6 ft. by 10 ft. and approximately 80 ft. long), fitted with explosion doors. From each of these headers a chimney discharges the gases to atmosphere at the same height as the moulding ventilation chimneys, that is, 100 ft. above the coremaking floor. Flame-failure protection equipment is incorporated at the burners, as are other safeguards, to give safety shut down and prevent damage in the case of gas, electrical, or compressed-air failure or mechanical breakdown

Oven Conveyors

Each oven carries a continuous-chain conveyor which also serves the coremaking lines. Cores are carried through the ovens on special carriers, transported pendulum wise from the chain and spaced 80 in. apart. These carriers are constructed of open angle-iron frames, 5 ft. 6 in. high, 4 ft. 6 in. long, and 3 ft. wide, containing adjustable steel shelves.

The coreovens are employed in two baking-cycle groups: each pair of ovens consists of one oven running at a 2-hr. 36-min. cycle, and the other on a 2-hr. cycle. All of these ovens have a fourpass system internally for the conveyor. The larger single oven is also employed on a 2-hr. 36-min. cycle, but embodies a 6-pass conveyor. The cycle time is basically designed around the standard coremaking and corebinder practice, but can be varied if necessary by a PIV (positively-infinitely-variable) reduction unit, incorporated on each conveyor drive. Conveyor drive units are located on the top of each oven.

To compensate for expansion due to temperature, each conveyor chain has a dead-weight tensioning cage at the end of the loop most remote from the oven. The five corebaking ovens operate at a temperature of 450 to 475 deg. F. The heating zones occupy approximately 70 per cent. of the conveyor length in the oven and there is a cooling zone to 30 per cent. of the oven conveyor length to enable the cores to be delivered to the core-dressing and assembly stations, cool enough to handle. As stated, the corebaking chain conveyors each serve a coreblowing line, the coremaker placing his production on the strand proceeding towards the oven and the coredressers removing baked (and cooled) cores from the outgoing strand.

A novel feature of the arrangement of the chain conveyor monorail is that it is sloped at the loading and unloading strands so that the top trays can be loaded or off-loaded conveniently at the low end of the slope and *viceversa.*

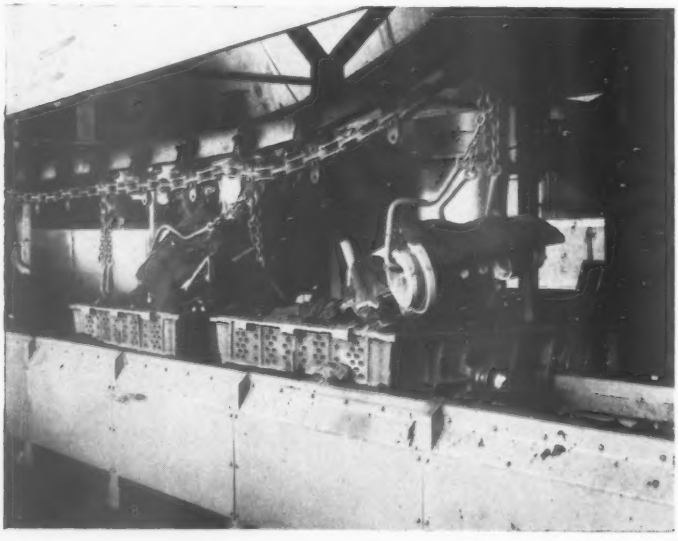

FIG. 30.—*"Dredging" (castings-removal) station on one of the mould conveyors. As the mould continues to move, hooks—loosely inserted into the casting at low level—pull the casting out of the sand as the chain conveyor rises; mould movement and chain conveyor travel are synchronized.*

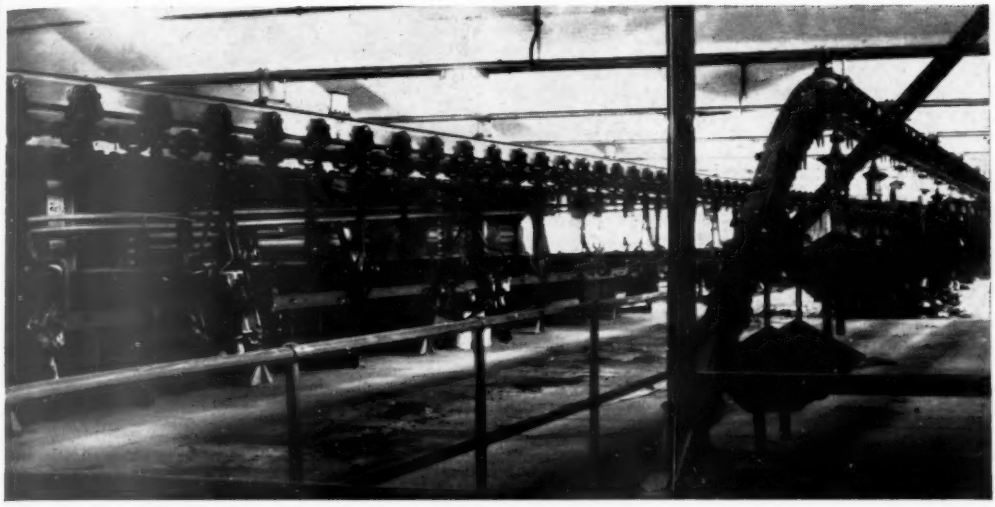

FIG. 31.—*Part of the cooling conveyor (left) and back-scrap conveyor (right). View taken across the east gallery looking in the direction of the main building.*

MOULDING

Fig. 1 shows the moulding section of the Thames Foundry in relation to the position of other major sections and Fig. 26 shows the detail layout and elevation. Moulding procedure is based on two lines each with eight O/J 12/36 model jolt-squeeze moulding machines (Figs. 27 and 28). They are described as straight-through machines, *i.e.*, the movements of the moulding flask and mould are in line with the direction of travel of the moulding-machine squeeze-head. A common flask is adopted for all jobs (size 45 by 30 by 16-in. deep each half) made of cast steel and each flask weighs about 800 lb.

Advantage of Specialization

The decision to incorporate all types of castings in one box size was an important one. It has meant that considerable ingenuity has had to be displayed in the patternshop in grouping smaller castings together and arranging single gating and feeding systems. For production control, too, it has meant that demands of items grouped together must be balanced as far as possible. Despite these drawbacks, the choice of a single size of mould has enormous advantages in handling throughout all phases of operation.

One production line (No. 1) is devoted mainly to cylinder-blocks and cylinder-heads and No. 2 line caters for heavy tractor castings. Barring of the moulding boxes for No. 1 and No. 2 lines is not identical, but in both cases, the bars divide the moulding box into 20 compartments, both with cope and drag halves. Then—in moulding—wooden blocks mounted on the machine squeeze-heads (and of height to suit the contour of the particular pattern) fit between the bars. One of the pads on the squeeze-heads forms the pouring cup of the mould, mating with a downgate-pin on the pattern. It has been found possible to arrange a minimum number of variations in design of squeeze-boards to suit groups of patterns.

All-metal patterns are employed in the Thames Foundry; they are purchased from outside master-patternmakers' shops, and maintenance is the only patternwork carried on at the Thames site.

Moulding Machines

Each of the two moulding lines consists of eight machines, four cope-machines and four drag-machines, in line. They are all semi-automatic in operation (Figs. 27 and 28). Each has a batch hopper for sand; this is, in reality, a metering box, and delivers about 800 lb. of sand to each half-mould. The batch hopper is attached to the squeeze-head of the machine and traverses with it, being automatically filled from the main sand hopper overhead during each squeeze period. The squeeze-head traverses in the same direction as the flask.

Machine Operational Squeeze

At the start of the cycle of operations performed by the moulding machines in making one half-mould, an empty moulding flask is in its place in the machine, with the machine rollers in the "up" position; the sand metering hopper is full and located over the empty flask. The movements then take the following sequence:—

(1) The empty moulding box is lowered on to the patternplate by a manually-operated control valve. When the box is in position over the pattern, the

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metering box empties its contents into the flask which is then jolted for a pre-set period.

(2) Movement of the metering box away for automatic re-filling also strickles off excess sand from the top of the jolted mould. The squeeze head is brought into position at the close of the strickle operation.

(3) The mould is then squeezed when the operator depresses two buttons—*one with each hand*—which brings up the mould on the pattern plate against the squeeze head. (The reason for having the two buttons is for safety—it means that the operator's hands are kept clear of the machine.)

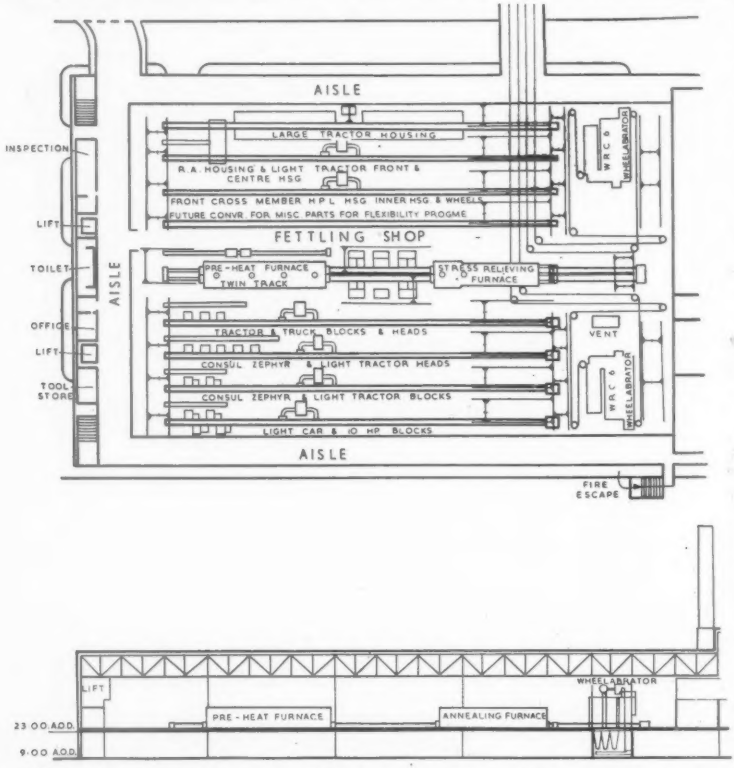


FIG. 32.—*Detail plan of the fettling areas at the west end of the main foundry building.*

(4) During the squeeze operation, the side-roller frames are brought up to the stripping position and the pattern is drawn downwards from the mould. The mould is then ejected on to the run-out rollers and an empty moulding flask (with the full metering hopper) is then brought forward preparatory to repeating the cycle.

Here it is interesting to record that return moulding flasks from the shakeout are "clawed" off the moulding flask return conveyor by the moulding machine itself as the squeeze head traverses forward. Thus the movement of the moulding machine head accomplishes three operations: (*a*) it collects an empty moulding flask; (*b*) it delivers one on to the moulding machine side rollers and over the pattern, and (*c*) it pushes a completed half-mould on to the run-out stand to await mould setting.

Cored-up moulds weigh about 3,500 lb. each and it is intended to produce 180 complete moulds per hr. from each line at present—on three pairs of machines, the fourth pair being on pattern change. This means that 60/70 half-moulds per hour will be produced from each machine at first. Each machine is manned by one machine operator and a mould-handler with one general helper.

There is a coring station situated on the mould conveyor between cope and drag machines, the whole core-assembly for each mould being put in by the "iron-man" type of core-assembly jig after the drag half-mould has been plumbago sprayed and skin dried. An oven is to be installed for automatic skin-drying on the moulding line.

Mould Conveyors

The actual mould conveyors (see Fig. 26) are of the pallet type, and of American design but made in the UK. Each is in the form of a continuous loop, with 137 pallets at 6-ft. centres. The pallets are 3-ft. wide with a ribbed top, and made of cast iron. Movement is effected by a "caterpillar" chain-drive employing a 27 h.p. d.c. variable-speed motor through a reduction gearbox. The conveyor speed can be varied from 12 to 24 ft. per minute. The pallets are individual units independent of the drive and one can be removed without affecting the remainder. Movement of the mould conveyor is extremely smooth and is accomplished by a special "feathering" action at the caterpillar drive. (To demonstrate this a pencil can be stood on its end without its falling over during starting and stopping of the mould conveyor.)

It will be remembered that in the section describing melting and pouring practice, the ladle (chain) conveyors at the pouring stations were reported to be synchronized with the mould conveyors. The cope- and drag-flask return conveyors also have variable speed to travel and this speed also is

FIG. 33.—*One of the primary sand-removal stations in the ancillary building. Ingates and runners are manually knocked off and sand is poked off and all drop into the jigging conveyor below.*

synchronized with the moulding line. The actual control of the speed—faster or slower—of travel for all conveyors after the original synchronization, is effected from a single control panel for each moulding line, situated on a gallery overhead and adjacent to the "drag" shakeout.

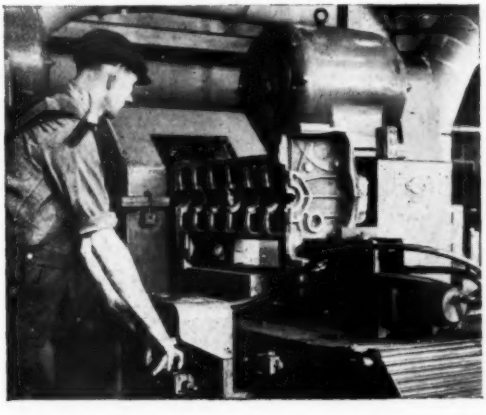
After coring, the moulds are closed while on the conveyor adjacent to the cope machines, all moulds being handled in bales suspended from overhead cranes. The bales have a safe working load of one ton and the hoists are air-operated to give extra control—the same remark applying also to the core-setting hoists. Cope and drag half-moulds are clamped (after assembly on loose pins) by "dog" clamps and the moulds move to the pouring station, which is about 50-ft. long and provided with a fume-extraction hood at the rear (see Fig. 29).

KNOCKING-OUT AND PRIMARY DRESSING

After pouring, the moulds pass into a fume-extraction tunnel, approximately 90 ft. long, and on emergence—on the same pallets—the pouring heads are removed (this takes place about 6 to 8 min. after pouring), and the box clamps are knocked off. Of interest at this point is the use of a small belt-conveyor for taking the clamps back to the mould clamping station on the mould conveyor, where they fall into a bin for re-use. After the clamps have been taken off, the pouring head is manually forked out of the mould and put into a basket on the "back-scrap" conveyor, which here runs adjacent to the mould conveyor.

This "back-scrap" conveyor is common to both moulding lines; it is of the endless chain type, and carries a total of 212 baskets at 6-ft. centres in its total length of 1,275 ft. It takes the heads, etc., to the back-scrap plant to be cleaned—before being sent to the cupolas for remelting—and eventually returns to the foundry. (This cleaning of back scrap is quiet a new and significant feature of Thames Foundry practice and will be mentioned again later.) Continuing on the same conveyor, the moulds enter a tunnel (approximately 100 ft. long), to the cope-half removal station. Here the cope part is lifted off by "claws" carried on a pneumatic hoist and is transferred by an air-cylinder device to the cope shakeout conveyor, under a hood on to a 12,000-lb. vibratory shakeout to remove the sand in the cope mould. The empty cope flask is then lifted on to the flask-return (chain) conveyor and taken back to the moulding machines. This conveyor has intermittent action controlled by the moulding machine demand so that there need be no excessive build-up of flasks at the moulding-machine stations. Flask selection from the conveyor is carried out by an operator pressing a button which stops the conveyor when the next flask is opposite the back of his moulding machine. A lifting arrangement raises the flask off the conveyor on rollers and the "claw" attached to the moulding machine draws it on to the run-in stand of the machine. There is room for two flasks on each run-in stand, a third in the machine and two others on the run-out stand.

FIG. 34.—*Cylinder-block casting being traversed between two face-grinding heads on one of the Snow flash-grinding machines.*



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Drag Shakeout

After the cope-mould has been removed, the drag still containing the hot casting and much of the sand—and still on the mould conveyor—travels under another tunnel to the casting-removal station. Here, the casting-cooling conveyor chain, which is returning from the cooling gallery overhead, drops down for a distance of 12 ft. This chain conveyor is synchronized with the mould conveyor and when it approaches the latter, hooks hung from the chain are manually attached to "eye-lets" (in fact, any convenient hole) on the castings. Then, as the cooling conveyor chain rises again, the castings are extracted from the mould (Fig. 30) and any loosely adhering moulding sand is removed by an operator armed with a long poker. The castings then travel with the chain over the east bridge (Fig. 31) to the castings cooling tower in the ancillary building.

The "after treatment" of the castings is dealt with in a later section, but here it should be mentioned that there are two main cooling conveyors—one for each of the two moulding lines and each conveyor is approximately 4,200 ft. long.

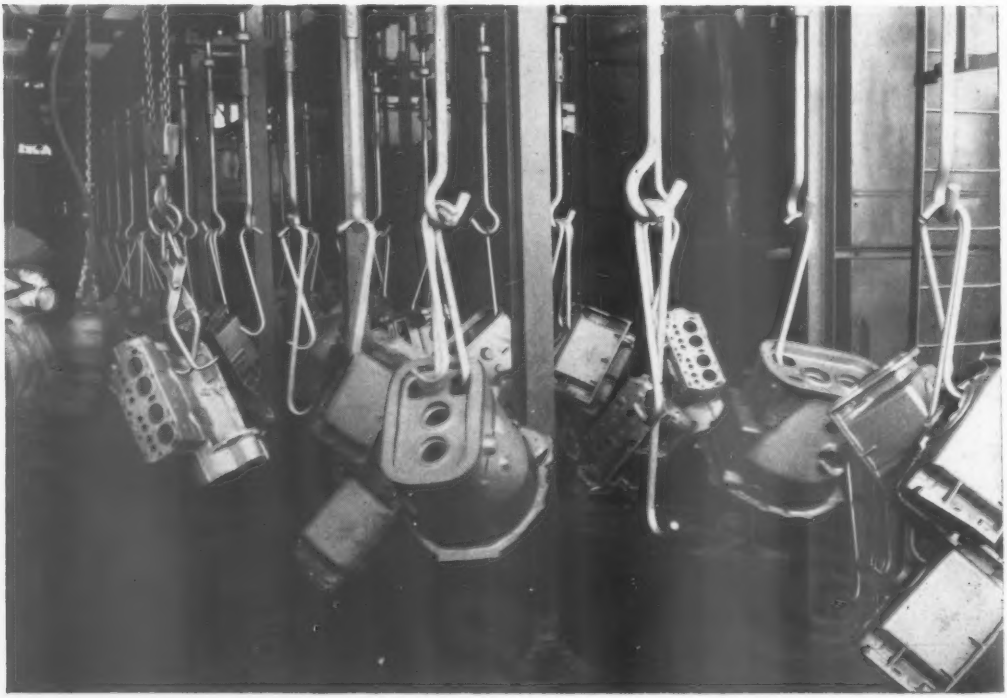
The drag mould continues on the mould conveyor to the drag shakeout station, where it is automatically pushed on to another vibratory shakeout. This is of the same type as used for cope flask, but of slightly different deck size. From this point, the flask returns to the drag-mould machines in similar manner to the cope parts.

To keep the top ribs of the mould conveyors free from sand, after the removal of the drag (and about 6 ft. away from the station), there is an automatic reciprocating brush which continuously sweeps the pallets clean. If any drag mould over-runs the push-off, it engages with a "policeman," which stops the wiper and prevents damage to it.

Cooling Conveyors

Each of the moulding lines is served by a cooling conveyor (Fig. 31), consisting of a monorail, chain and trolley-type carriers, whose function it is to extract the hot castings from the drag moulds, and then to cool them to room temperature before delivering them to the knockout and grinding section. The cooling conveyors (serving No. 1 and No. 2 production lines, respectively) withdraw from the moulds the red-hot castings hooked on to them at the "dredging stations," referred to earlier in this section (Fig. 30), and take them first to a higher level and then out of the main building across the east gallery into the "primary cooling" section housed in the ancillary building. Here each chain conveyor carries the castings over

FIG. 35.—*Exit end of one of the continuous Wheelabrator plants. Note the heavy loading of the conveyor hooks.*



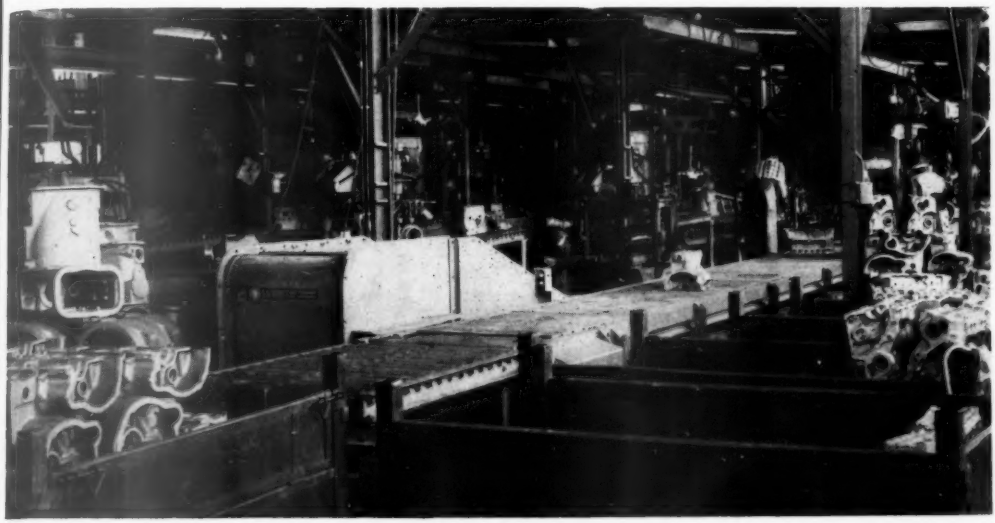


FIG. 36.—*View of the slat conveyors, taken from the west end of the fettling section, stillages of castings can be seen in the foreground.*

350 ft. of zig-zag loops inside the building, natural ventilation being provided through the asbestos-louvred walls of this part of the building.

This ends the "primary cooling" section; the chain conveyor then takes the castings (still on the same hooks) to what is termed the "primary crack-off" section, where the risers and feeders are removed. This area is served by four dust- and fume-extraction systems, with a total capacity of 160,000 cub. ft. of air per min. and is equipped with a battery of Rotoclone wet-type dust collectors, located in the open at ground level near the north side of the ancillary building. In the "primary crack-off" area, any castings joined to others (through being made in the same mould) are broken apart—this applies particularly to pairs of small cylinder-block castings. All this is completed while the castings remain on the conveyor hooks. They then continue to the final cooling section of the chain-conveyor's travel (2,000 ft. long) before reaching the final knock-out.

Chain Conveyors

The cooling conveyors themselves are worthy of note. Each is approximately 4,500 ft. long, and each chain is driven by nine drive units, each comprising a two-speed motor of 725 and 975 r.p.m., coupled to a hydraulic coupling which in turn is coupled to a pair of speed-reduction units (one giving a variable ratio which allows a conveyor speed varying from 12 to 24 ft. per min. The conveyor trolleys are at 2-ft. pitch and each is capable of taking a ½-ton load.

Twelve emergency-stop buttons are provided in the course of each conveyor's travel at various operating and possible emergency points in addition there are two master control panels adjacent to each moulding system and here a warning light system indicates at which one of the 12 points the conveyor has been stopped. This enables the conveyor to be re-started without undue delay.

Back-scrap Conveyor

Back-scrap—pouring heads and runners—for which the ultimate destination is the cupola plant for re-melting, is loaded at the pouring-head removal station into suspended steel baskets (carried on the same type of chain as the cooling conveyor). The baskets are arranged at 6-ft. pitch. The conveyor is arranged to bring these to the primary-cooling area, referred to earlier, where they are automatically tipped to jettison their contents into a chute leading to the back-scrap treatment plant, located on the ground floor of the ancillary building. The speed of the back-scrap conveyor (Fig. 31) is 16 ft. per min., the total length is 1,275 ft., and has two constant-speed drive units.

Back-scrap Plant

Quite a new operation—that of cleaning the back scrap before returning it to the cupolas for re-melting—is a departure from the orthodox which is paying good dividends at the Thames Foundry. The function of this back-scrap plant—as it is termed—is to separate metal from sand and other contamination. The sand-covered back scrap has been delivered as already mentioned above, and is tipped into a chute leading to an electro-magnetic vibrating conveyor. This discharges into an inclined rotating barrel (the sprue mill). A system of mechanically-driven "jigging" conveyors also delivers all the "knocked-out cores" and back scrap from the "crack-off" and "knockout" stations,

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into the sprue mill described later. (The mechanical "jigging" conveyors are lengths of open steel troughs about 14 in. wide and 6 in. deep which move with a reciprocating motion and shuffle their contents from one end to the other.) The residual sand from the "crack off" and "knockout" stations passes along the "jigging" conveyor system through a grille which permits the loose sand to be transferred on to a belt conveyor equipped with a magnetic pulley and Overband magnetic separator. This metal-free waste sand is then carried by bucket-elevator to a 70-ton waste-sand hopper from which it is ultimately taken to the dump by rail wagon.

Sprue Mill

The back scrap, together with knockout cores, enter the sprue mill where any adhering sand is detached from the metal and corelumps are broken up by a tumbling action in the mill's rotating inclined barrel. The mill is 5-ft. dia., 25-ft. long, weighs 12 tons, and can deal with 30 tons per hr. Loose sand escapes from the mill through perforations at the lower end of the barrel, thence by vibratory conveyor and a secondary belt to the main discard sand-conveyor. The scrap metal tips out from the end of the mill and is taken on a "leak-proof" type of conveyor (3-ft. wide, 140-ft. centres) to discharge into a waiting rail wagon and thus, back to the melting plants.

The ventilation system to this plant is equipped with a wet-type dust separation unit, handling 20,000 cub. ft. of air per min. No reclamation of waste sand from this plant is practised at present.

FETTLING

Fettling of castings at the Thames Foundry really embraces two distinct sections—rough preparation, chipping and "flash" grinding (which takes place in the ancillary building) and ordinary fettling carried out on slat conveyors, etc., back in the main building at the western end (Fig. 32).

General

In order to reduce the amount of chipping by operators equipped with pneumatic chisels and/or electric grinders, the Ford engineers have, in conjunction with a machine-tool manufacturer, designed special-purpose machines known as "flash grinders."

This "flash grinding" is located in the ancillary building and is equally divided into two sections for dealing with (*a*) all cylinder-block and cylinder-head castings, and (*b*) all tractor transmission housings, etc. Here, once again, there are two parallel installations to permit transfer of these castings from the two cooling conveyors, vibrate them, and free them from sand (Fig. 33), "flash-grind" them, and hang them on to two service (chain) conveyors on which they are transported over the west gallery to the fettling shop proper. A central "jigging" conveyor system, 348-ft. long and 2-ft. wide, is employed here to return scrap metal and waste sand from the vibrators mentioned above.

On arrival in the fettling shop, the castings on the service conveyor automatically pass through one of two six-wheel continuous Wheelabrator units (more details later) and on emerging from this unit each casting is unloaded by means of an electric hoist and crane on to a vibrator—to remove the spent abrasive—before feeding the casting on to the slat conveyors (on which they are fettled by the application of portable tools); thereafter, they pass through "spot-blasting" units and finally, if no water-test is required, they are loaded into large tote bins ready for shipment to the company's casting storage area (located on the ground floor immediately below) or direct to the machine shops.

Grinding-shop Equipment

The vibrators in the grinding shop are mechanically-operated triplex units designed by Ford engineers; they are 52-in. wide and 20-ft. long. Each of the seven slat conveyors—on which rough chipping of castings is carried out in order to fit them on the grinding fixtures later—are 36-ft. long by 2-ft. 6-in. wide. For "flash-grinding" there are 13 heavy-duty fixed grinders, most of them incorporating two face-grinding heads with 30-in. dia. wheels; each wheel is driven by a 50-h.p. motor. These grinding wheels are in line but opposing each other and in this way, they are able to grind two faces of a casting simultaneously—the head and sump faces of a cylinder-block, for instance (Fig. 34). Castings are offered to the grinding wheels on an automatic feed, after being lifted from the castings conveyor by hoist, and clamped to the grinding-machine table with special hydraulic fixtures. On some of these grinders, the wheels are arranged at right-angles to each other and in that case, casting faces in similar relationship can be "flash ground" simultaneously in one pass. Tractor transmission-housings are examples of castings requiring this type of treatment. All the flash grinders are fitted with dust-extraction units leading to the Rotoclone wet collectors previously mentioned. Each machine weighs about 10 tons.

The electric hoists for handling castings in this shop are 4-cwt. and 8-cwt. capacity. They are light enough to be moved by hand, a factor which facilitates easy changeover and reduces operator fatigue.

Advantages of "Flash" Grinding

Another feature of the grinders, which really do—on a mechanical basis—all the heavy work of preparing castings for the machine-shops, is the automatic compensating feed incorporated to take care of wheel wear. The employment of these machines is regarded as a great advance in the technique of automobile-castings manufacture, as they reduce subsequent fettling operations to minor touching up of the interior of castings and represent, at the same time, a large saving in man-power over the methods previously employed. They are also a means of keeping the grinding-shop atmosphere free from dust pollution.

Dust extraction from the flash-grinding shop-vibrators, slat conveyors (chipping) and flash

FIG. 37.—*Unobstructed view of the slat conveyors in the main fettling area.*

grinders is by means of wet collectors (Rotoclones, type "C"), six units handling 36,000 and three handling 24,000 cub. ft. per min., being employed in this section, *i.e.* 30,000 cub. ft. per min. from each vibrator and slat conveyor system and up to 8,000 cub. ft. per min. from each of the flash grinders.

Fettling-shop Details

Each of the two service overhead monorail conveyors of Ford standard design which transport castings from the flash-grinding shop across the west gallery to the fettling shop is 1,500-ft. long. First, they lead castings to *and through* the Wheelabrator cabinets. This arrangement reduces pick-up and put-down handling. Each of the continuous Wheelabrator plants employs six 20-in. dia. impeller units capable of throwing about 1 ton of abrasive per min.; round chilled-iron shot is employed here. The wheels, mounted on one side only, are staggered to give a complete "shadow," to cater for castings up to 4-ft. deep. Each cabinet employs three passes of the conveyor; the cabinets themselves are lined with hardened-steel wear plates. The dust extraction from these units is handled by 32,000 cub. ft. min. Rotoclones.

A special feature here, to avoid excessive maintenance, is the employment of ductwork (leading from the Wheelabrators to the Rotoclones) constructed of steel plate $\frac{1}{8}$-in. thick, with rubber linings at the bends.

Slat Conveyors

Special vibrators are used at the beginning of the fettling lines to free castings from—and to reclaim—spent abrasive carried over from the Wheelabrators. In total, there are eight variable-speed, slat conveyors (Figs. 36 and 37) for fettling. They are 183-ft. long, 2-ft. 6-in. wide, arranged in parallel along the shop, 12-ft. apart. An interesting provision here is their arrangement at varying heights above floor-level (21 to 32-in.) according to the type of castings handled at a given point. This is so that the height of the conveyor plus the height of the casting on which an operator is working comes within a comfortable range for working with portable grinders and the like. This greatly delays operator fatigue; on one of the conveyors—that handling tractor housings—the operators work from platforms alongside the conveyor because the castings themselves vary from 30 to 36 in. high. These steel platforms are covered with wood to reduce noise propogation and to give a non-slip surface for grinding operations.

Only a minimum of touching-up fettling is carried out on these lines, concentrating on the interiors of astings and employing portable air-operated chipping hammers and Hicycle grinders for this purpose. Incidentally, the frequency changer units for these high-frequency (120 cycles per second) tools are located on the ground floor below the fettling shop.

"Spot" Blasting

An important phase of final cleaning is "spot" blasting of the interiors, etc., in 5-ft. cabinet shot-blasting units of special design, with all parts above floor level, one of which is adjacent to each of the slat conveyors at a distance of 65 ft. from the finishing end. These are hand operated from outside by means of a nozzle control to direct the stream of abrasive where needed. The interior is

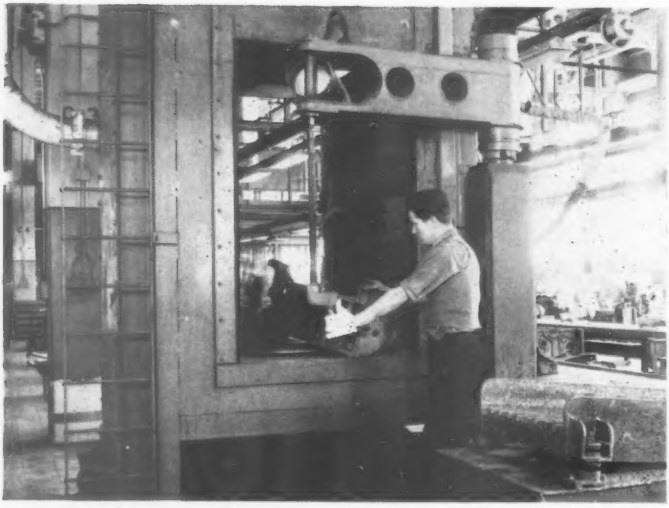


FIG. 38.—*One of the spot-blasting units mounted beside a slat conveyor in the fettling shop. Note the use of a pneumatically-operated articulated arm for handling castings in and out.*

roughly 5 ft. cube and the castings sit on a powered rotary table with a stop/start control to enable the operator to work at just the angle desired. The handling of castings in from one side of these cabinets and out from the other is effected by extremely efficient specially-designed articulated pneumatic hoists, mounted on free-standing pedestals close to the cabinets (one at each side of each unit). This makes available an effective pick-up movement of almost 360 deg. the pick-up arm is articulated so as to reach from the slat conveyor and deposit the castings right inside the spot-blast unit (Fig. 38), before being retracted, to permit closure of the door.

Dust Exhaust from Shot-blasting

Yet another feature worth mention in this shop is that all dust and silt from the Wheelabrators (*i.e.*, that not entrained in the extracted air) is first handled by En-masse conveyors, taken on to the roof and entrained in the water sluices for eventual conveyance to the settling tank. The dust-laden air, collected at the same points, is passed through "Buell" dry collectors before passing to the wet-type Rotoclones. All this is done to reduce the dust loading of the Rotoclones to reasonable levels —a most important provision.

Inspection and Despatch

After spot-blasting, castings are inspected on the final length of the slat conveyors and water-tested, if necessary, on semi-automatic machines, themselves operated hydraulically. Here it is noteworthy that the operator remains stationary while the clamping fixture of the testing machine manipulates the casting into a number of positions, while under water-pressure, so that it can be viewed from various angles. Castings finally taken from the slat conveyors are stacked in large "tote" bins 68-in. long by 42-in. deep and after being taken by lift to the ground floor, are transported trailer-wise to the company's machine-shops at the Dagenham works or to storage areas. This mass movement is effected by special tractors drawing up to six trailers. Diesel-engined fork-lift trucks of 6,000-lb. capacity and 3,000-lb. capacity "Work-savers" are employed for general transport in the fettling shop.

Other Points of Interest

Among a number of points of special interest observed in the flash-grinding and fettling shops is the impression of spaciousness conferred by the high roof of the latter. Another device worth noting is the provision of acoustic panelling to reduce noise from the vibrators in the ancillary building—it certain improves conditions for other operators in the shop. The counter-balanced suspension method for small hand tools used in the fettling shop is noteworthy—if only because it is a fatigue-saving provision quite usually found in machine and assembly shops, but rarely in foundries.

VENTILATION, DUST AND FUME REMOVAL

Recalling the figure of £500,000 quoted—in the section describing the Thames Foundry building—for the cost of heating and general ventilating, it should be pointed out that even this high amount (more than one-sixth of the total building-cost) does not include specialized dust- and fume-removal plant. If the cost of that were added, the grand total would approach £750,000—a not inconsiderable sum to spend on indirect employee welfare!

As with all other projects connected with the new foundry, both general and specialized ventilation (including dust- and fume-removal) were planned as complete entities before construction commenced. Thus, one is permitted to examine a really integrated system which takes into account all known sources of dust and fume arising in the foundry and deals with the whole problem of collection of contaminated air, separation of its solids content and disposal of both, all on a really comprehensive basis.

Major attention has been given to the moulding, pouring, knocking-out and sand-treatment plant as areas requiring special treatment from a dust-extraction point of view. It must not be forgotten, however, that a number of somewhat dirty and dust-producing operations were already segregated

in the ancillary building. Indeed, the localization of fumes and dust arising from such items as the casting-cooling conveyor, primary dressing of castings, sand-drying, and slurry plant was the reason behind the provision of the ancillary building.

In connection with the moulding, pouring and cooling of castings, the following points are equipped with dust- and fume-extraction plant:

(*a*) *Pouring stations*—here, on each line, side hoods (Fig. 29) are provided at the back of the mould conveyors over a length of 61 ft. Air is withdrawn from the hoods at 66,000 cub. ft. per min., while at the same time compensating air is introduced from *outside* the building in winter and *inside* in summer; this is to reduce the loss of warm air in winter and to augment the ingress of air from outside during summer.

(*b*) *Mould tunnels*—A total volume of 88,500 cub. ft. per min. is exhausted from the three sections of mould conveyor tunnel on each line and compensating air (at about two-thirds of that volume) is introduced at the ends of each section.

(*c*) *The clamp-removal station* is exhausted by an overhead canopy, 37,600 cub. ft. per min.

(*d*) *The cope-removal and cope shakeout*, are all exhausted, a total of 48,800 cub. ft. per min. being handled by overhead hoods.

(*e*) At the *casting-removal station*, which includes the drag shakeout, 55,220 cub. ft. per min. are exhausted by overhead hoods.

Disposal

In the moulding section, extract ventilation is also arranged from all hoppers, etc., beneath the floor—for example, at the sand-collection points, all sand-conveyor transfer points, at the rotary screen and the sand-storage hoppers.

Wherever dust may be airborne, the collected effluent is taken in ductwork to the roof of the building, where a series of Rotoclone wet collectors (Figs. 9 and 39) are available to effect separation of dust and air. The aggregate capacity of the six Rotoclone installations serving the moulding section is 184,000 cub. ft. per min. In each case, the extracted solid material from these systems is entrained with water streams carried on the roof in U-shaped open sluices and leading to the main sluice downcomer (shown on the extreme left of Fig. 9), and thence first to one of the sedimentation tanks and afterwards to the settling ponds.

Where only fumes are collected, all ducts lead to one of three 10-ft. i.d. brick-lined chimneys, which are mounted on special supports inside the building and project through the roof. They discharge the collected smoke to atmosphere at their outlets, at 110 ft. above the ground.

One quite real problem with such elaborate dust- and fume-removal systems is the risk of fire, due to oil-fumes condensate collecting in the ducting. As a precaution against this hazard, a CO_2 extinguisher system has been installed throughout the mould-conveyor tunnels and fume-exhaust ducting.

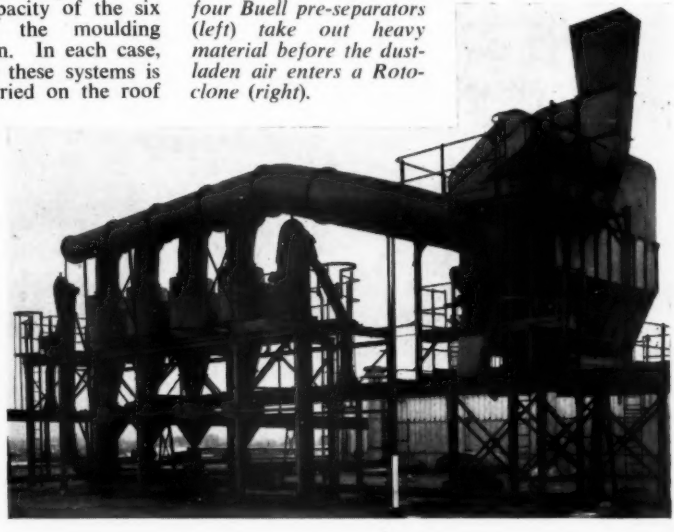
Rotoclone wet-type collectors also handle dust-laden air from coregrinders in the coreshop and the Wheelabrators, shotblast cabinets and snaggers in the fettling shop. In the ancillary building, a total of fourteen Rotoclones exhaust from the knockout sections and backscrap handling plant. There is no sluice system in the ancillary building and the Rotoclones here are of the sludge-ejector conveyor type. These conveyors deposit the collected dust in the form of a sludge into portable containers which are periodically removed by fork-lift truck for emptying.

SUPPLEMENTARY INFORMATION

Amenities

Arrangements have been made so that employees arrive at the foundry, *via* a new bridge over the railway, from the main arterial road, crossing the River Beam by another new bridge which gives direct access to the foundry site. Provision has been made for cycle and car parks and there is also a public-transport terminus where workmen alight close to the centre (on the north side) of the main building. They then pass through the security gates and into cloakrooms in which double-compartment, heated-and-ventilated clothes-lockers are provided, one for each man. The total number of lockers is about 2,000. Adjoining the locker rooms are the ablution facilities (of the circular-fountain type) and also the showerbath cubicles and

FIG. 39.—*Dust-separation unit on the roof; four Buell pre-separators (left) take out heavy material before the dust-laden air enters a Roto-clone (right).*



the usual toilets. Conditions in this area are kept at a constant temperature by a separate ventilation system of warm and clean air with extra "comfort" heating being provided in the changing rooms and showers. From here, the workmen can pass along the ground-floor passage and ascend to the main operational floor by the main access stairways.

Canteens—on the ground floor—for employees consist of a main kitchen (with a tea-preparation room and stores) as well as facilities for food preparation, mechanical dishwashing, baking, and cold storage for food—all on a self-contained basis. The main canteen will seat 700 people at each sitting and hot meals are served from an up-to-date serving counter operating on a cafeteria system, based on the latest hygienic lines. Provision is also made for up to 70 members of the staff in a separate dining room.

Special consideration has been given to the provision of comprehensive medical facilities to cope with any emergency. The main medical station is 60 by 60 ft., subdivided into a waiting room, doctors' room, nurses' room; separate cubicles are available for the treatment of cuts, burns, eye injuries, etc. In addition there is an X-ray room, housing some of the very latest equipment and adjoining this is a darkroom for film processing. (A medical examination of all employees is insisted upon on engagement.) On the working floor, at the hot-metal end, there is also a first-aid station for dealing quickly with minor injuries.

Analytical Laboratory

The operation of the foundry calls for rapid metal analysis, as well as careful checks on raw materials, sand, etc., which go into the moulds and cores. A laboratory, therefore, has been provided to deal with metal analysis and a separate section is devoted to sand testing and core testing. These laboratories are specially air-conditioned, have first-class fluorescent lighting and are equipped with the very latest equipment.

Transport Facilities

The whole project of the Thames Foundry includes a well-organized system of railways, incorporating both running tracks and reception sidings. These connect with the main railway system by a newly-constructed under-bridge which crosses the River Beam and building this formed part of the main construction scheme. Rail tracks handle coke from the Ford ovens, pig-iron and scrap from the storage areas, sand from the storage yard and limestone from outside suppliers. Certain materials are brought into the works by bulk-storage containers and this traffic is carried on perimeter roads around the building—access ramps being provided at either end of the foundry to lead to the main operational floor. Certain areas immediately surrounding the foundry are to be sown with grass seed to reduce the possibility of dust. Access to the foundry at the points marked on the plan view (Fig. 1) is gained by electrically-operated tilting doors or sectional stacking doors, both of these types representing a distinct departure from the orthodox and have been selected with the objective of giving a maximum clear opening allied to rapid open and closing action.

Offices

Offices are provided on the ground floor of the main building for foundry managers, paymaster, time clerks, works standards personnel, shift superintendents, and the production-engineering staff and embody the usual staff amenities. Here again, great care has been taken in the planning and equipping of these offices to ensure a clean, warm atmosphere in winter and good ventilation in summer. They have excellent artificial lighting and acoustically-treated ceilings. This section is isolated from operational noises, in order to provide the staff with optimum working conditions.

Also on the ground floor is the maintenance department which, of course, is primarily concerned with preventive and emergency attention to machinery and plant. However, it must not be forgotten that a building structure of this type, embodying ventilation and heating arrangements on such a scale, itself require proper provision for maintenance and cleaning and in fact, a special section has been set up for this purpose.

As would be expected in a project of this nature, the types of floor-surfaces employed have been given careful consideration, so that at each location, durable flooring is provided to suit the operations carried on there. Conditions ranging from severe abrasion and the possible impact of "falling bodies" to the hygienic requirements of the medical department are encountered. Surfaces, therefore, include the use of granolithic concrete (in the substations, for example), Adamantine tiling, armoured cement-concrete tiling, monolithic hardened concrete surfacing, 3-in. wood-block floors (maintenance department), firebrick paving (in hot-metal areas), thermoplastic tile (in the offices), decorative clay tiles (in the canteen) and Terrazzo in the medical stations.

Other Services

Before closing this section, it is germane to refer to the general fire precautions. Water services for fire-fighting purposes have been installed on the ring- and rising-main principle, with hydrants both inside and outside the building. In addition, locations where there is special fire hazard have been equipped with automatic CO_2-dispensing equipment, for example, in the electrical substations, fume-exhauster shafts, the oil-storage depot, and the kitchen. The special fire-protection arranged at the transformer stations is by means of Buchholz protective relays which give a warning by hooter of incipient transformer faults and trip out the transformer long before the fault develops, this preventing any possibility of major damage to the electrical equipment.

Of the other services supplied to the foundry, steam is possibly the most important. This is taken by a trestled pipeway, 10-in. dia., at high pressure from the existing Ford powerhouse at the Dagenham works. The steam load is around 90,000 lb. per hr. at 150 lb. pressure per sq. in., reduced at the

foundry end to a working pressure of 80 lb. per sq. in. Condensate from the steam is returned to the powerhouse *via* a condensate pumping-station (located under the west ramp) by a pipeline carried on the same trestle way. Also carried on the trestle way is the gas main taking coke-oven gas from the Dagenham foundry to the new installation. For this, a 10-in. dia. pipe is employed to carry the 150,000 cub. ft. per hr. required in the new foundry installations. The water demand for the new foundry, in addition to that supplied for cooling purposes (and referred to elsewhere), is 3,000 galls. per hr. for domestic purposes.

Clean Air Provisions

It will be seen from the preceding account and amplified in what follows that the Clean Air Act provisions, and those of the Foundry Health and Safety Regulations, have been well taken care of in the Thames Foundry, to avoid any possibility of nuisance due to atmospheric pollution to interior personnel or neighbours. Indeed, the writer from personal observation endorses the claim that the new foundry represents a quite new high standard of dust-free cleanliness and good-housekeeping.

Compressed-air Supplies

Ranking in importance with steam supplies to the Thames Foundry, the compressed-air services are catered for on a very lavish scale, both for present-day needs and possible future extension. Thus, the compressor-house, situated on the north side of the ground floor in the main building, has accommodation for 15 compressors. Ten of these are already installed, and they are double-acting, two-stage units, each giving 760 cub. ft. per min. of "free" air at 125 lb. per sq. in. pressure.

Foundrymen will be somewhat surprised to note the provision of air services at such a high pressure, but it must immediately be pointed out that 125 lb. per sq. in. is used specially for the coreblowers and the pressure is reduced down to 100 or 80 or even 40 lb. for the many other uses.

Filters

Air is drawn into the compressor house through a louvred opening in the outside wall of the compressor-house, passing through two Ventex filters and then *via* concrete-lined ducts of 4-ft. sq. section under the floor, with branches to the individual compressor air-intakes. These branch intakes are formed of salt-glazed earthenware pipes below the floor level terminating in 8-in. dia. sheet-metal ducts to the compressor inlet. The same main underground ducts admit cooling air to the compressor motors.

After compression, the air passes first through water-cooled after-coolers and then to individual air receivers (total receiver capacity at the compressor house being 2,287 cub. ft. free air). Before supply in the distribution lines, any entrained oil is filtered out from the air which is then dried in one of two "Lectrodryer" chemical absorber plants. Each of these plants consists of two cylinders of activated alumina which are used alternately and periodically "rejuvenated" after a period of use by drying out with the aid of built-in steam coils. The compressors themselves and their after-coolers are water-cooled by a recirculatory type of system which employs a forced-draught cooler, located on the roof of the building. The water is gravity fed from the cooler, through the compressor to a storage tank and then pumped back to the cooler by three pumps, each capable of delivering 400 gall. per min. against a 70-ft. head. All the compressors have automatic unloading devices and are brought into operation according to the air demand.

Compressed-air Distribution

Air is distributed throughout the foundry through Class "C" mild-steel pipes, these being sized to keep the pressure drop less than 2½ lb. per sq. in. per 1,000 ft. of pipe. All pressure-reducing valves have been duplicated so that any valve can be taken out of service for overhaul, etc., without interrupting the supply of air to any section of the distribution system. Where heavy instantaneous demands are made on the compressed-air supply (as at the core machines and moulding machines), large-diameter pipes have been placed immediately adjacent to the machines to safeguard against any pressure drop during the machine cycle. In the moulding department, each group of four moulding machines is connected to a 24-in. dia. pipe, 50-ft. long. Pipes ranging in diameter from 12 to 20 in. and 120-ft. long have been used in a similar manner in the core department.

The complete electrical installation in the foundry, including all sub-main distribution for power, heating, ventilation and lighting services, has involved the installation of approximately 10 miles of paper-insulated lead-covered and armoured cables, having a total weight of approximately 300 tons. In addition, there are some 30 miles of conduits, enclosing approximately 150 miles of other assorted cables. The lighting installation extends to a total of 5,500 lighting units, with a total loading of approximately 900 kW.

COMMENT

When one considers that exploratory boring on the site started in August, 1954, the first pile was driven on March 15, 1955, and regular metal casting commenced on December 17, 1957, it will be generally agreed that phenomenal progress was made in erection and equipping.

The new Thames Foundry employs 1,800 operators and the output per man/hour of the particular castings involved is twice that under previous methods of manufacture.

It will be clear to foundrymen reading this account that developments embodied in the Thames Foundry have been of an evolutionary character and of these there is a vast number. What has been accomplished—and exceedingly well—is that mass-production processes have been applied in new and logical ways, to take them in varying stages—dependent on the process—further towards complete "automation." Novel methods of control have been instituted to fuse isolated procedures

Ford's Thames Foundry

together in one vast integrated unit, with the aid of all the mechanical and electrical devices known to the age.

By concentrating attention on well-established processes, an incredible wealth of detail improvement has been accomplished in literally thousands of directions—so much so that no doubt for many years to come, the Thames Foundry will be held in high esteem as a model of its kind. It is a monument to the down-to-earth practical engineers who are responsible for its conception, erection and operation.

On this note, it is desired to bring to an end the JOURNAL'S report. Even at this unprecedented length, it is still not exhaustive, but it is hoped that every reader will have found in the record something of personal benefit. To the writer, compiling the story has proved an exacting exercise—a "refresher course," as it were, to reconvince him that there's always something new and fascinating to learn about founding, even of the highly-mechanized variety. At the Thames foundry—as in all other foundries—there is a whiff of that something really creative which seems to entitle foundrymen to set themselves a little apart from their less-fortunate brethren.

Acknowledgment

It remains to acknowledge, with gratitude, the permission of Sir Patrick Hennessy, speaking for the board of the Ford Motor Company, to print this account, and to thank all the Ford engineers who have assisted in its production. Praise is due both to Ford's staff and the equipment manufacturers and materials suppliers (who co-operated so fully in the project) on carrying through a tremendous job so rapidly to such an impressive conclusion.

CONTRACTORS AND RAW-MATERIAL & EQUIPMENT SUPPLIERS TO THE NEW THAMES FOUNDRY

AS CONTRACTORS:

Acme Conveyors, Limited (mould convevors, sprue mill).
Allen, Edgar & Company, Limited (rotary cooler screens).
Atlas Copco, Limited (pneumatic hoists).
Allspeeds, Limited (speed variators).
Andrews & Platt (Engineers), Limited (hooks for cooling conveyors).
August's, Limited (coresand mixers).
Abisch Conveyor & Furnace Company, Limited (belt conveyors).
Air Control Installations, Limited (dust-extraction systems).
Allam, E. P. & Company, Limited (vibrating machines).
Aabacas Engineering Company, Limited (Demag electric hoists).
Allen, Alfred & Son, Limited (coal-dust containers).
Avery-Hardoll, Limited (pre-set electric kerbside pump).
Angel Truck Company, Limited (pallet trailers).
Bates Bros. (Engineers), Limited (coke-handling skips, pallets, pattern-storage racks, self-dumping hopper-bins).
H. Beck & Company, Limited (metal pouring ladles).
Brown & Tawse, Limited (steelwork erectors).
Braby, Fredk. & Company, Limited (corewash dip-tanks).
Barry Henry & Cook, Limited (idler-wheel assemblies).
British Monorail, Limited (gantries and runways for mould handling).
Bawn, W. B. & Company, Limited (steel clothes-lockers).
Brasshouse, Peter, Limited (water-pressure testing machines).
Beardsley Piper Div., Pettibone Mulliken Corp. (coreblowing machines).
Buell Combustion Company, Limited (dust collectors).
Brownings' Electric Company, Limited (trolley assemblies).
Birlec, Limited (compressed-air dryers).
B.V.B. Appliances, Limited (steel cribbing).
Constructional Engineering Company, Limited (cupolas, cupola weighing equipment).
Cupodel, Limited (hot-blast recuperator units).
Cook & Company, Limited (pouring platforms).
Crescent-Webb, Limited (monorail chain and trolley assemblies).
Cocksedge & Company, Limited (drive sprocketts and shear flanges).
Crane Company (pneumatic sand-delivery system).
Coleman-Wallwork Company, Limited (vibrating shakeouts).
Crockett Lowe, Limited (metal patterns, coreboxes, core-assembly fixtures).
C. & M. Engineering Company, Limited (Buell-type separators).
Crompton Parkinson, Limited (electric motors).
Coventry Climax Engines, Limited (fork-lift trucks).
Coreshooters Sales, Limited (coreblowing machines).
Dowler, H. J. (Engineers' Patternmakers), Limited (metal patterns, coreboxes).
Darrold Engineering Company, Limited (conveyor and elevator equipment).
Donovan Electrical Company, Limited (power-conductor rail).
Distington Engineering Company, Limited (jigging conveyors).
Dickinson, C. B. (Grays), Limited (steelwork erectors).
Eonit Engineering Company, Limited (moulding machine run-in stands).
English Steel Castings Corporation, Limited (moulding flasks).
Ellis, James W. & Company, Limited (belt conveyors).
Foxboro-Yoxall, Limited (control instruments).
Farr, Edward, Limited (sand-storage hoppers).
Foundry Equipment, Limited (moulding sand-distribution system).
Foster, A. (Constructional Engineers), Limited (steelwork erectors).
Farrar Boilerworks, Limited (air receivers).
Freeman Heating Company, Limited (piping contractors).
General Engineering (Ilford), Limited (coreboxes, core-assembly fixtures).
Griffiths, A. E. (Smethwick), Limited (run-in stands, ducting).
General Constructional & Engineering Company (Bedford & Son), Limited (sand-storage hoppers, access walkways and platforms).
Green, R. & H. & Silley Weir, Limited (coresand platforms, storage hoppers).
Graviner Engineering Company, Limited (explosion-suppression equipment).
General Engineering (Hayes), Limited (access platforms and walkways).
Hopper, H. C. (Kingston), Limited (metal patterns, coreboxes, core-assembly fixtures, core-drier equipment).
Holmes, W. C. & Company, Limited (ventilating equipment).
Hunter & English, Limited (Wheelabrator rotating hangers).
Heenan & Froude, Limited (water cooler).
Holden & Brooke, Limited (centrifugal pumps).
Hearsall Pattern & Castings Company, Limited (metal patterns and coreboxes).
Herl, Jean (metal coreboxes).
Igranic Electric Company, Limited (electric switchgear, starter-panel equipment).
Industrial & General Engineering Company (pipework).
James Mills, Exors of, Limited (spike anchors).
Jeffrey Manufacturing Company (moulding-sand aerators).
Jackman, J. W., & Company, Limited (moulding and core-making machines).
King, Geo. W., Limited (ladle tractor units, metal-pouring system).
Kidde, Walter, Company, Limited (fire-prevention equipment).
Kramer & Grebe, KG (metal patterns, coreboxes).
Keith Blackman, Limited (high-pressure blowers, fan equipment).
Lennox Foundry Company, Limited (sand-drying equipment).
Light Metal Fabrications (1946), Limited (basket assemblies for back-scrap conveyor).
Lockers (Engineers), Limited (vibrating units).
Lang Pneumatic, Limited (pneumatic control equipment).
Lloyd Lawrence, Limited (monorail conveyors).
Levy, B., & Company (Patterns), Limited (metal patterns, coreboxes).
Meissner & Company (metal patterns, coreboxes).
Monometer Manufacturing Company, Limited (hot-metal receivers).
Mitchell Bros. (Steelwork), Limited (cranes, gantries).
M.T.E. Control Gear, Limited (electrical control equipment).
Matthews & Yates, Limited (horizontal coreovens).
Metropolitan-Vickers Electrical Company, Limited (infra-red corewash drying-oven and conveyor).
Midland Fan Company, Limited (ventilation equipment).
Morris, Herbert, Limited (Speedmullers).
New Conveyor Company, Limited (monorail conveyor for cores).
Ozonair Engineering Company, Limited (air-filter units).
Pratchitt Bros., Limited (slurry plant).
Premo Pattern Company, Limited (metal patterns, coreboxes, core-assembly fixtures, core-drier equipment).

Perry, G., & Sons, Limited (metal patterns, coreboxes, core-drying equipment).
Prat-Daniel (Stanmore), Limited (gas-washing equipment).
Redler Conveyors, Limited (sand elevators and conveyors).
Ryemor Engineering Company, Limited (ball-bearing roller assemblies).
Reavell & Company, Limited (air compressors).
Rowland, F. E., & Company, Limited (snagging machines).
Riley (I.C.) Products, Limited (vibrating conveyors).
Sinex Engineering Company, Limited (sand-mixing equipment).
Stordy Engineering, Limited (coreovens).
Spencer (Melksham), Limited (wagon-tippers).
Saunders & Taylor, Limited (piping contractors).
St. Georges Engineers, Limited ("spot-blast" equipment).
Simmons & Hawker, Limited (piping contractors).
Serck Radiators, Limited (after coolers).
Strachan & Henshaw, Limited (telpher cars and track).
Smedley Bros., Limited (ganister mills).
Stott, S. S., Limited (sand-handling equipment).
Stokes, Taylor & Shaw, Limited (sand spillage hoppers).
Stone-Wallwork, Limited (monorail conveyor drive-units).
Sanders & Forster, Limited (service conveyors).
Simmonds Aerocessories, Limited (hydrostatic gauges).
Square, D., Limited (control panels).
Sheppard & Sons, Limited (pig-casting machines).
Sarginson Bros., Limited (metal patterns, coreboxes, core-assembly fixtures).
Snow & Company, Limited (grinders).
Tilghman's, Limited (continuous Wheelabrator equipment).
Teleflex Products, Limited (core-dipping conveyors).
Universal Pattern & Precision Engineering Company, Limited (metal patterns, core-drier equipment, coreboxes, core-assembly fixtures).
Willard Engineering, Limited (ventilating equipment).
Wright & Platt, Limited (metal patterns, coreboxes, core-assembly fixtures).

AS SUPPLIERS:
Acme Flooring & Paving Company (1904), Limited (wood-block flooring).
Andrew Machine Construction Company, Limited (ventilation equipment).
Aberdare Cables, Limited (cables).
Benham & Sons, Limited (ventilation equipment).
Brown & Tawse Tubes, Limited (lighting standards).
Booth, John, & Sons (Bolton), Limited (steel doors).
Burgess Products Company, Limited (acoustic ceilings).
Bowan, F., Glassworks, Limited (glazing).
British Insulated Callender's Cables, Limited (cables).
Babcock & Wilcox, Limited (cranes).
British Thomson-Houston Company, Limited (lighting fittings).
Boydell, E., & Company, Limited (diesel dumpers).
Concrete, Limited (roof decking).
Clayton Crane & Hoist Company, Limited (travelling gantries).
Crompton Parkinson, Limited (sub-station switchgear).
Clarke, T., & Company, Limited (cables and wiring).
Cotton, Thomas, Limited (painting).
Charldwood, Alfred, & Sons, Limited (plastering).
Concrete Development Company, Limited (piles—supply only).
Cox & Company (Watford), Limited (dining-room chairs).
Courtney Pope (Electrical), Limited (lighting fittings).
Davidson & Company, Limited (fresh-air fans).
Drake & Gorham, Limited (electrical contractors).
Dorman, Long & Company, Limited (structural steelwork).
Dow-Mac Products, Limited (pre-stressed concrete piles—supply only).
Dare-Inglis Products, Limited (dining-room tables).
Dawson Bros., Limited (dishwashers).
Elgood, E. J., Limited (tile paving).
English Electric Company, Limited (distribution boards).
Excel Asphalte Company, Limited (asphalt tanking).
Farmer, S. W., & Son, Limited ("cat" ladders).
Freeman Heating Company, Limited (compressed-air mains).
Ferguson, H. K., of Great Britain, Limited (consultants, main contractors).
Finch, B., & Company, Limited (sink units).
Fire Equipment, Limited (hydrant fittings).
Foster, Arthur (Constructional Engineers), Limited ("cat" ladders).
French, W. & C., Limited (site levelling, gas and water mains).
General Asphalte Company, Limited (road surfacing).
Guest, Keen, Nettlefolds (Cwmbran), Limited (baseplates).
Grant Lyon, Limited (rail tracks).
General Electric Company, Limited (lighting fittings).
Gleeson, M. J. (Contractors), Limited (pile-driving).
Hope, Henry, & Sons, Limited (metal windows).
Hall & Company, Limited (asbestos cladding).
Haden, G. N., & Sons, Limited (gas, steam and heating services).
Hackbridge & Hewittic Electric Company, Limited (d.c. rectifier).
Hide & Company, Limited (dining-room chairs).
Johnson & Phillips, Limited (low-tension switchgear).
Laing, John, & Son, Limited (main contractors).
MacNab & Company (Flooring), Limited (Duromit flooring).
Morrison Pumps, Limited (sluicing pumps).
Monk, F., & Sons (Barge Builders) (sluicing systems).
Metropolitan-Vickers Electrical Company, Limited (power-station switchgear).
Midland Iron & Hardware Company (Cradley Heath), Limited (sluice valves).
National Enamels, Limited (sub-station signs).
Normid, Limited (boring *in situ*, piling).
Parkes, Josiah, & Sons, Limited (locks).
Parker Winder & Achurch, Limited (ironmongery).
Prove Bros., Limited (security fencing).
Painters C. & T., Limited (painting steelwork).
P.B. Industrial Flooring, Limited (granolithic flooring).
Pinching & Walton, Limited (cables).
Pressure Piling Company (Parent), Limited (pressure piles).
Ragusa Asphalte Paving Company, Limited (asphalt roofing).
Rother Boiler Company, Limited (calorifiers).
Refrigeration (East Anglia), Limited (cold-storage units).
Rowe Bros. & Company, Limited (office partitions).
Stitson Sanitary Fittings, Limited (sanitary fittings).
Semtex, Limited (thermoplastic tiles).
St. James Tile Company (Terrazzo).
Summers & Company, Limited (glazed tiling).
Shouksmith, J. H., & Son, Limited (plumbing).
Southerns, Limited (doors).
Soil Mechanics, Limited (site investigation).
Stent Precast Concrete, Limited (piles—supply only).
Summerson, Thos., & Sons, Limited (railway crossing).
Staveley Iron & Chemical Company, Limited (cast-iron pipes).
Stott, James, & Company (Engineers), Limited (kitchen equipment).
Staines Kitchen Equipment Company, Limited (cup-washing machine).
Sumerling & Company, Limited (kitchen tables).
Standard Telephones & Cables, Limited (capacitors).
Simmons & Hawker, Limited (compressed-air mains).
Saunders & Taylor, Limited (pipe connections).
Tubewrights, Limited (guard railings).
Taylor Bros. (Sandiacre), Limited (rail tracks).
Victor Products (Wallsend), Limited (lighting fittings).
Wilson & Wylie (floor tiling).
Worthington-Simpson, Limited (heating pumps).
Westland Engineers, Limited (external doors).
Walter, D., & Company, Limited (convector-heater panelling).
Weatherill, F. E., Limited (loading shovel).
Wadsworth, Wm., & Sons, Limited (lifts in ancillary building).

Osborn's "Open" Days

The official opening of the new Holbrook Steelworks at Eckington, near Sheffield, of Samuel Osborn & Company, Limited, is to take place on June 3. (An account of the works is to be published shortly in the JOURNAL and will include a technical review of processes operated there.) This works at present houses the precision-casting activities of the firm, embracing Shaw, shell and CO_2 moulding processes, but it is intended to develop the site to house future extensions.

A tour of the new works by members of the Press and other guests on the opening day will be preceded by luncheon at the Royal Victoria Station Hotel, Sheffield, and visitors will leave for the Holbrook works at 2.30 p.m. A series of "Open Days" is to be held during the months of June and July to which other groups of visitors will be specially invited.

Shaw Process US Convention

Mr. Clifford Shaw has returned from the United States where he atended a convention of western hemisphere licensees of the Shaw Process, in Port Washington, Long Island. Over 80 representatives were present for the three days of technical sessions and discussions, which included a paper on a new vacuum casting and melting furnace. Other contributions were from Mr. G. W. Paget, formerly of the De Havilland Engine Company, and now of Deloro Smelting and Refining Company, Limited, and Mr. Carter, formerly of Metropolitan-Vickers, Manchester, and now of Hitchiner Manufacturing Company. The third day was devoted to a demonstration of the developments at the laboratories of the Shaw Process Development Corporation. During the past year, £15,000 worth of arc furnaces and similar equipment has been shipped to Shaw Process licensees.

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Publications Received

Purchasing for Stock, by Peter Bailey. Published by the Purchasing Officers' Association, Wardrobe Court, 146A, Queen Victoria Street London, E.C.4; price 2s. 6d.

Probably, intuition is the usual factor influencing the amount and the timing of buying materials for stock. This booklet shows, through an analysis of the situations which arise, how an intuition can be intelligently directed. It is pointed out that it costs money to hold stocks and still more to be under supplied, and the ascertainment of the correct quantity to be purchased by large and small concerns has been worked out using simple arithmetic. The foundries buy many millions of pounds worth of materials during a year and the study of this inexpensive pamphlet may result in the elimination or reduction of extensive mistakes. Salesmen, too, should familiarize themselves with it, as through a knowledge of the "buyer's" background, he may be able to exercise his powers of good salesmanship—that is, when the buyer says "no."

For a Competitive Edge. Issued by Westinghouse Blairsville Metals Plant Materials Manufacturing Department, Blairsville, Pa, USA.

This 20-page brochure is exceptionally well printed, the illustrations, type, and paper are alike of high quality. It tells of the starting up of a metallurgical development service, using pilot plants for the improvement of the firm's products. Thus established, the services are now placed at the disposal of industry in general. In 173,000 sq. ft. of laboratory space, facilities are provided for examining the potentialities of the lost-wax process, shell-moulded castings, heat-treatment, and powder metallurgy. Hot- and cold-rolling and forging facilities are installed. The brochure makes very interesting reading.

National Foundry College. Annual Report 1956/57. Published from Stafford Street, Wolverhampton.

This report tells of the continued progress of the College. The number of students enrolled for Part I of the diploma course was higher than ever before, whilst 19 took Part II. Apart from the usual activities, there was organized a study tour covering Belgium and Germany, whilst special courses for foundry foremen and supervisors, and on the subject of running and feeding of castings were held. Unquestionably the College is making a major contribution to the industry's need for trained technologists.

Steel Castings for Crushing Machinery. Issued by the British Steelfounders' Association, Broomgrove Lodge, Broomgrove Road, Sheffield, 10.

This *Bulletin* addresses itself to cement and concrete makers and quarry owners, for it shows by illustration and well-written letterpress, the services accorded to them by the steelfounder in the provision of hard and tough castings. As an appendix there is a glossary of rock names. The illustrations have been particularly well chosen.

Wild Barfield Heat-treatment Journal, Vol. VI, No. 46. Published by Wild-Barfield Electric Furnaces, Limited, Otterspool Way, Watford By-pass, Watford.

The first article in this publication covers the determination of carbon, phosphorus and sulphur in steel, by using the fluorite polychromator, which is a modified spectrographic apparatus. It emphasizes the lines for the elements, which in the ordinary way are fairly grey. A second article covers the research equipment installed in the works of the Hoffman Manufacturing Company, Limited, whilst a third deals with resistance-heated furnaces in the aluminium industry—mainly the fabricating end of it.

House Organs

Bradley's Magazine, No. 72. Issued by Bradley & Foster, Limited, Darlaston, Staffs.

This issue contains an interesting article on gases in cast iron. It tells the practical foundryman just what he wants to know of the subject. Dealt with are the three elements, oxygen, hydrogen and nitrogen, and in connection with the latter a table, reproduced below, shows its incidence of gas pick-up in cupola practice when using increasing quantities of steel scrap.

Percentage of steel scrap in cupola charge	Nitrogen Parts per million
8.33	44
25.00	51
50.00	53
75.00	60
83.33	64
100.00	71

This company rightly takes pride in the fact that they were one of the pioneers in this field of investigation.

There is a second article on "Basic Refined Irons" which is of real interest, as it shows that through the use of a basic-lined cupola, a whole range of new pig-irons has become available. One of these, designed to meet the requirements of the Sheffield crucible-steel trade, would have been extremely valuable 50 years before the advent of the electric steel furnace. It is a "white" pig, used for mixing with pure bar iron to yield any desired carbon content. This type of iron was originally imported in large quantities from Sweden. Other products are pig-irons for making spheroidal-graphite iron; high-manganese irons for steelmaking and the like.

ACEC Expo 58. Vol. 1. No. 1. Issued by the Ateliers de Constructions Electriques de Charleroi.

This publication is in the format of a newspaper. Its objective is to place before visitors to the Brussels International Exhibition, the part which ACEC plays in the industrial activity of Belgium. It is a huge plant occupying 247 acres, a working space of 418,950 sq. yds. and a staff of 14,000. The news bulletin indicates a few of the great projects for which the firm has been responsible and indicates the nature of its participation in the exhibition.

Malleable Iron Facts. No. 57. Issued by the Malleable Founders' Society, Union Commerce Building, Cleveland 14, Ohio, USA.

This series of bulletins always pursues the same sensible theme, that of the redesign of castings, associated with reduction in weight and costs. In this issue examples are given of a plough clamp with a weight reduction of 18.95 per cent. and a 17.05 per cent. lowered cost, and a trailer axle seat with a 16.92 per cent. weight reduction.

Platinum Metals Review, Vol. 2, No. 2. Issued by Johnson, Matthey & Company, Limited, Hatton Garden, London, E.C.1.

This review stresses the place of the rarer metals—especially platinum—in every-day engineering, and moreover does it using interesting, easily-understood language. Such subjects as the design of platinum-wound electric-resistance furnaces and "cermets," dealt with in the booklet, are of quite wide interest.

Institute of British Foundrymen

Annual Conference in Buxton, May 13 to 16

With the East Midlands branch as hosts and their nominee taking over the presidency, this year's conference of the Institute of British Foundrymen was held in Buxton, Derbyshire. What follows is a brief report on the proceedings, social and technical, and comment on some of the papers presented.

Two changes from established routine marked this year's conference of the Institute of British Foundrymen held in Buxton from Tuesday, May 13 to Friday, May 16 inclusive. The first change was the bringing forward of conference week to mid-May instead of June; this was done to give members the extra comfort to be expected from hotels before holiday-period congestion. The second innovation was the start of the conference on the Tuesday—a day earlier in the week than usual—to accommodate an extra series of works visits.

To cut a long story short, the first change was of doubtful benefit, because so many members found hotel accommodation in Buxton of such a quality as to be unaffected by the incidence of holiday crowds. Secondly, of course, from the point of view of internal arrangements, the holding of the Institute's annual general meeting one month earlier must have placed quite a heavy strain on the Institute's staff. The fact that numbers attending some of the functions were lower than usual must also be related in some measure to the earlier dates. However, the second change—that of holding extra works visits—was an unqualified success. East Midlands foundries are numerous and have much to show to the visitor; the opportunities offered for viewing them, on the whole, were well made use of by members.

Tuesday's Functions

Those members and wives who had stayed overnight in Buxton travelled pleasantly by coach on Tuesday morning to Derby. Here, over a luncheon at the Midland Hotel, they were joined by others who had started out that day. After lunch, the coaches were boarded again for works visits in the Derby area. Separate parties of members went to the foundry of their choice out of six—Ley's Malleable; Qualcast; Rolls-Royce; Parker Foundry; International Combustion, and Aiton's—which had extended invitations on that occasion. All were quite well attended (bearing in mind that by other years' standards this was a pre-conference series of visits) and those who participated were loud in praise of the facilities offered and courtesies shown. The writer went to Qualcast, Limited, where for the first time he was able to see the die-casting of iron carried out on a real mass-production basis, in addition to viewing the firm's other foundries at Victory Road, Derby. Opinions expressed amongst the membership of other parties showed that much that was novel had been shown to them and that the visits had been very profitable, technically speaking, as well as very pleasant when viewed from the social and amenities angle.

While these visits had been in progress, the conference ladies had also been inspecting works—either Crown Derby Porcelain Company, Limited, or Leisure Kitchen Equipment Company, Limited (the latter being a subsidiary of Allied Ironfounders, Limited—and they later joined members at tea at the New Inn Hotel, near Ashbourne. All parties then returned to their respective hotels in Buxton.

On Tuesday evening, beginning at 8.30 p.m. and continuing until midnight, members and ladies attended a reception held by the Mayor and Mayoress of Buxton at the Pavilion Gardens. Supporting the Mayor (Councillor J. Bootherstone, J.P.) and Mayoress (Mrs. Bootherstone) at this function were Mr. J. Blakiston, M.I.MECH.E. (the IBF president) and Mrs. Blakiston and the (then) senior vice-president (Mr. A. E. Peace) and Mrs. Peace. Refreshments, dancing and light entertainment followed.

Annual General Meeting

After re-assembly next morning (Wednesday) and whilst their ladies were attending an informal reception by Mrs. Peace and Mrs. Blakiston, held in the Palace Hotel, Buxton, members of the Institute foregathered in the "Playhouse" at the Pavilion Gardens for the fifty-fifth annual general meeting. About 200 were present; Mr. Blakiston took the chair, supported at the dais by Mr. Peace, Mr. C. H. Wilson (junior vice-president) and Mr. G. Lambert (the secretary).

The minutes of the last annual general meeting, having been circulated, were taken as read, and the president then extended a welcome to overseas guests, amongst whom he named Mr. M. Jeancolas (representing the *Association Technique de Fonderie*) from France; Mr. Banerjee, and Mr. Chakrabarty from India; Mr. Hobson from Northern Rhodesia; Mr. Bos from Holland; Mr. Pratt from Australia; Mr. Pacyna from Germany, and Mr. Eugster from Switzerland.

Annual Report and Balance Sheet

Next the annual report of the Institute's Council (previously circulated) was adopted and following that (in the absence abroad of Mr. N. P. Newman, the treasurer) the balance sheet was presented by Mr. J. G. Bailes, chairman, membership committee. Mr. Bailes was supported in recommending acceptance of the balance sheet by Mr. J. Bell (past-president) who also congratulated all the Institute's branches for their share in the betterment of the financial position which had resulted from increased receipts for membership subscriptions.

At this stage, Mr. S. H. Russell (past-president) put forward a plea for the building up of the fund for providing the award annually of the Institute's E. J. Fox Medal, to take proper account of the depreciation of currency since the medal had been

FIGS. 1 TO 7.—*Photographs taken during the Buxton conference of the Institute of British Foundrymen.*

Fig. 1 (facing camera, left to right): The Mayor (Councillor J. Bootherstone, J.P.) and Mayoress of Buxton, with Mr. Blakiston, M.I.Mech.E., Mrs. Blakiston, Mr. A. E. Peace and Mrs. Peace, welcoming guests at the Civic Reception on the Tuesday. In Figs. 2 and 3 the new president, Mr. A. E. Peace and Mrs. Peace, are shown welcoming guests at the annual banquet on the Wednesday evening (in Fig. 2 it is Lord and Lady Hives who are being received). In Fig. 4 Mr. J. Blakiston is shown investing his successor, Mr. A. E. Peace, with the presidential chain of office, and in Fig. 5 he is congratulating the new senior vice-president, Mr. C. H. Wilson, on assuming that office. Fig. 6 shows Dr. A. B. Everest (past-president) receiving a Meritorious Services' Medal for conveyance to Mr. V. Delport, and in Fig. 7 Mr. Blakiston has just placed the junior vice-president's insignia on the shoulders of Mr. G. R. Shotton, F.I.M.

instituted. He thought it should be possible so to augment the fund as to make the award of a gold instead of a gilt medal. It was stated in reply that the matter was on the agenda for the next meeting of Council.

Technical Council's Report

Continuing the meeting, Mr. M. M. Hallett, M.SC., the newly-elected chairman of the Institute's Technical Council, presented its annual report (already circulated). Initially, he referred to the prospective election of the Council's late chairman to the higher office of president of the Institute, saying that in that respect the Institute's gain was the Technical Council's loss.

As the Council's annual report had been circulated, he only needed, he said, to refer to major points. One of these was the publication by the Council of the volume of "Typical Microstructures of Cast Metals," which had already received such wide acclaim that it looked like becoming a "classic" in the foundry world. This had been the result of the work of three of the Council's sub-committees, T.S.40, T.S.41, and T.S.42, under the co-ordinating guidance of Mr. P. A. Russell. Two other sub-committees of the Council—dealing with non-ferrous surface finish and melt quality—Mr. Hallett continued, would be presenting reports at the present conference. The work of some other sub-committees was drawing to a close and here he instanced those dealing with internal stress, flow of metal and mould drying. Still very active, he said, were those on cupola development, mould materials, foundry coke, feeding, castings design, terms and definitions, and melting conditions. Thus the whole field of foundry technology was being studied from the point of view of giving practical guidance to members.

Mr. Hallett's proposal for the adoption of the report was seconded by the Council's new vice-president, Dr. D. V. Atterton, who mentioned in particular the value of the financial support received from the Joint Iron Council and technical help from the Universities of Birmingham and Durham, the learned institutes, research associations, and manufacturers' associations. Co-operation with the British Standards Institution and its various committees had also proved very helpful, Dr. Atterton said, in concluding his remarks before the formal acceptance of the resolution.

Presentation of Awards

At this stage in the meeting, Mr. Blakiston presented the principal awards of the Institute as follow:—

E. J. Fox Medal: This medal and the accompanying parchment citation was given to Mr. P. A. Russell, B.SC., in recognition of his outstanding contributions to the industry in technical and other spheres. Acknowledging the honour, Mr. Russell said, *inter alia,* that, because of the donor's associations, he had always regarded the medal as an East Midlands award and on that account was doubly pleased to receive it.

Oliver Stubbs Medal: This was awarded to Mr. M. M. Hallett, M.SC., for his contributions to foundry technology over many years, his services on the Institute's Technical Council and in connection with the Institute's publications. In reply to the citation, Mr. Hallett mentioned his good fortune in having been employed for many years by public-spirited companies who had given him complete freedom for activities within the Institute.

Meritorious Services' Medals: This year there were two of these medals awarded. One went to Mr. G. D. Thompson for services with Victoria (Australia) founders for many years and more recently since these had been incorporated within the Institute. The second was awarded to Mr. Vincent Delport for his work for a very long period on the IBF Council and in international foundry circles. As Mr. Thompson was not present, it was arranged for his medal to be sent to him. Dr. A. B. Everest agreed to convey the award, along with the Institute's good wishes, to Mr. Delport, who was absent owing to illness.

On learning he was to be given the award, Mr. Delport had written the following message to be delivered by Dr. Everest:

"I am very appreciative of the honour conferred on me by the award of the Meritorious Services' Medal. During many years, I have been very happy to serve the Institute both in national and international spheres. If I may pass on a message to members at this meeting, I would direct it especially to the younger members and ask them to participate wholeheartedly in giving papers and in technical-committee work for the Institute. Maximum satisfaction in life is gained from voluntary service, and the vitality and future success of the Institute is dependent on such service from its younger members, who will be the officers of tomorrow."

British Foundry Medal: This medal for 1958 and prize of £10 (both donated by the FOUNDRY TRADE JOURNAL) were given to the author of the paper adjudged to be the best of those included in the

FIG. 8.—*Mr. P. A. Russell, B.Sc., receiving the E. J. Fox Medal from Mr. J. Blakiston (the retiring president).*

1957 volume of the Institute's *Proceedings*. The recipient was Mr. C. W. Hicks (of Rolls-Royce, Limited) for his paper on the "Manufacture of Aircraft-engine Castings."

Diplomas: The president then announced the award of the Institute diplomas: To Mr. I. Rees and Mr. D. H. Snelson for their paper on "Aids to Production in a Jobbing Foundry," to Mr. J. Jarvis for the paper "Ultrasonics in the Foundry," and to Mr. F. Gaiger, joint author of "Methods Engineering, with Emphasis on Flow Process Control Applied to Fettling Shops."

Election of Officers, 1958-59

Taking the next item on the agenda, Mr. Blakiston proposed that Mr. A. E. Peace should take over the office of president for the coming year, and mentioned the real practical way in which he had furthered the interests of the Institute over many years. Mr. J. W. Gardom seconded the proposition which was carried with acclamation. Mr. Peace, after presenting a past-president's badge to Mr. Blakiston, asked him to continue in the Chair for the remainder of the meeting.

Mr. H. J. V. Williams in proposing that Mr. C. H. Wilson be elected as senior vice-president said that it was a personal pleasure to him to do so, and mentioned Mr. Wilson's wide experience both at home and abroad, also his connection with the education of youth. The proposal was seconded by Mr. J. Vickers from the Tees-side branch and carried, and Mr. Blakiston then invested Mr. Wilson with the senior vice-president's badge. Mr. S. H. Russell proposed that Mr. G. R. Shotton (who had been a member since 1932) be junior vice-president, and Dr. J. E. Hurst, J.P., seconded the proposal. Mr. Shotton was duly elected and acknowledged the honour, jocularly mentioning the "black-heartedness" of both the president and himself (both are engaged in the production of black-heart malleable-iron castings). On the proposal of Mr. J. G. Bailes (seconded by Mr. D. E. Catton) J. & A. W. Sully & Company were then elected as auditors.

The five Members of Council elected by ballot for a two-year period were Mr. H. G. Hall, Mr. M. M. Hallett, Mr. J. Hill, Mr. R. F. Horton and Mr. P. A. Russell.

Thanks to the President

Following the election of officers, Mr. Peace proposed a vote of thanks to Mr. Blakiston for the way in which he had met the tremendous demands made upon him during his year of office. Mr. Blakiston, acknowledging, said his main purpose had been consolidation of the Institute's financial

FIG. 9.—*(left) Mr. M. M. Hallett, M.Sc., addressing members assembled at the annual general meeting, after having been presented with the Oliver Stubbs Medal.*

FIG. 10.—*Mr. Barrington Hooper, C.B.E. (facing camera) congratulating Mr. C. H. Hicks after presenting to him the British Foundry Medal and £10 prize for his paper on the "Manufacture of Aircraft-engine Castings."*

position, which had reached its highest level during 1957. Credit for this, however, was not due to him, but to the co-operation and wholehearted efforts of the various senior executives. He then announced that the Worshipful Company of Founders had granted the use of their hall for certain meetings of the Institute. In referring to the crescendo of activities in which the Institute now participated, he said that he thought it was desirable that the "load" now borne by the president and secretary should be spread among the juniors in office. He concluded by thanking all the members for their hospitality and friendship during the year.

On Mr. Blakiston's suggestion, the meeting then agreed that a cable of greetings be sent to the American Foundrymen's Society. In conclusion, Mr. K. Marshall proposed and it was resolved that a message of sympathy should be sent to Mr. Delport.

Presidential Address

Mr. A. E. Peace then delivered his presidential address taking for his theme "Some Aspects of Mould-making." He said that his remarks arose from a background of mass-production green-sand moulding, but in many aspects they would also apply to other types of mould materials and moulding methods. All the activities of the Institute, he said, were aimed ultimately at the production of good castings. They aimed, he continued, to produce these castings with the maximum efficiency so that the foundry industry's products were economically attractive and competitive with other materials and methods of fabrication. One great attribute of production by casting was the ability to produce intricacy of shape. Intricate designs introduced many problems in manufacture and founders naturally called for all the simplification that could be obtained, but founders should always bear in mind that the very complication of shape might be the *raison d'etre* for the choice of a casting.

Many of the varied specific characteristics were determined almost entirely by the metallurgy of the metal, Mr. Peace continued, and falling into this category were electro-magnetic properties, corrosion-resistance and the like. However, many other physical and mechanical features needed to perform the service required, whilst generally thought to be of a purely metallurgical nature, were in fact affected by the quality of the mould into which the metal was poured.

A variety of finishing processes were applied to castings and all foundrymen appreciated the importance of the mould quality in obtaining a satisfactory surface to accept the particular type of finish applied. In order that castings should be capable of being machined satisfactorily, and particularly now that high-production machining methods and equipment were generally used, and also that they should lend themselves to ready assembly and incorporation in engineering constructions, Mr. Peace continued, it was essential that a high degree of dimensional accuracy and consistency be obtained. How many foundrymen, he asked, knew what variation in weight was obtained from one casting to another, from one day to the next? Under conditions which might be regarded as reasonably well controlled, a weight variation of 5 per cent. was quite usual and a variation as high as 10 per cent. was by no means abnormal. Such weight differences involved much higher dimensional variations. Were foundrymen inclined too readily to put these differences down to the vagaries of metal contraction or to effects of the casting shape and size?

Mr. Peace then went on to say that the effects of the geometry of the casting upon contraction could be considerable but were non-variant for any constant design and method of running. These effects of shape could be varied but only to a very slight extent by changes in pouring temperature, which might result in some alteration to the temperature differentials in the poured mould and casting. There remained, he said, the over-riding factor in dimensional variation, namely, the quality of the mould.

The surface hardness of the mould was of great importance because of its effect upon surface finish of the casting, mould erosion and the like, but it was of little value by itself in assessing the rigidity of the mould which is the paramount factor in determining dimensional consistency of the casting. It was perhaps better to think of this mould-quality factor as mould dilation, and in this context, Mr. Peace said, mould dilation was defined as a general expansion of the mould cavity due to lack of rigidity. It did not refer to near surface expansion in the mould wall which is a thermal expansion of the sand and the cause of scabs and buckles. Neither did it refer to what were commonly known as "swells," which were due to extreme and localized expansion of the mould and were recognized by an obvious mis-shapen effect. Mould dilation as defined was more subtle and could not be recognized by simple observation. It was necessary to investigate it by measurement of weight and dimensions of the casting and by density determinations carried out on selected sections of the mould. Apart from the effects of varying mould density upon casting dimensions, this factor in mould quality could be responsible for other casting defects. For example, if a casting was gated and fed so that in a mould of good density the casting was just sound and free from any liquid shrinkage defects, such a casting would be unsound when cast in a mould of lower density. The lower density allowed greater mould-dilation to occur, giving a casting of greater volume which would not be adequately fed by the feeder provided.

Thoughts on this factor of mould quality inevitably led foundrymen to wonder if they gave enough consideration to the use of moulding machines and methods of ramming. Did they use the machines to the best advantage? Did they control the operations of mould making so as to obtain the greatest uniformity in mould quality? It was questionable, Mr. Peace went on, whether foundrymen always used the most appropriate machine or method of ramming to suit the particular casting, especially so in cases where the casting was deeply

IBF Conference at Buxton

or awkwardly contoured. This question also applied to the depth and size of moulding box as related to insufficient or excessive mould-wall thickness.

Mr. Peace said that in the time available, he had only been able to stress certain effects of mould density and to refer to a limited number of factors affecting it. He stressed the important bearing of sand condition and quality upon this feature of rammed density.

He reminded his audience that it was the mould which made the casting. A well-made mould could make a good casting, a bad mould never could. He asked the foundrymen to reflect upon how much of the fettling, straightening and welding and other such after-processes were carried out because the moulds made were not good ones. At this point, Mr. Peace said he wanted to sound a note of warning. He asked foundrymen to be careful how they used impressions. Impressions were not facts and they were not knowledge. This must be recognized and impressions must not be used to determine the operations. Impressions were valuable when used properly. Finally, Mr. Peace ended his address by asserting that these impressions were most useful in suggesting lines of investigation and avenues of exploration, but besought foundrymen to use their knowledge and deductions from what was proved to determine their operational procedure.

(To be continued)

News in Brief

ARMOUR CHEMICAL INDUSTRIES, LIMITED, has taken over the business of the chemical division and the Armour laboratories, hitherto part of Armour & Company, Limited.

OWING TO A DECLINE in demand for steel castings, John Fowler & Company (Leeds), Limited, Sprotbrough, near Doncaster, has put 450 workers on to a four-day week.

HIGH DUTY ALLOYS, LIMITED, announce that as from June 2, the address of their Scotland and Northern Ireland area sales office will be Atholl Avenue, Hillington, Glasgow, S.W.2.

BARCLAYS BANK D.C.O. reports from South Africa that Ferralloys, Limited (a new company in the Anglo-Vaal Group), is to build a £12,000,000 ferro-manganese plant shortly at Cato Ridge in Natal.

THE CHEMICAL PLANT DIVISION of the Power-Gas Corporation, Limited, Stockton-on-Tees, has obtained an order from Kali-Chemie A.G., Hannover, Germany, for the supply of a Power-Gas/Hercules reforming plant.

F. PERKINS, LIMITED, diesel-engine manufacturers, of Peterborough (Northants), has formed a German company, F. Perkins Kundendienst, to ensure after-sales service for its engines. Since 1952, nearly 10,000 engines have been exported to Germany.

DISMANTLING of the Vauxhall Gasworks, now being carried out by Mayer, Newman & Company, Limited, London, W.C.2, is expected to take about eight months. In addition to a large quantity of scrap iron and steel the company will have for disposal numerous reuseable items.

THE SOUTHERN SECTION of the Institute of Vitreous Enamellers is to visit the Dagenham works of the Ford Motor Company, Limited, on Tuesday, June 3. Applications to join the party can still be accepted if telephoned immediately to the section secretary (Mr. L. E. Turner) at CHA 9281.

MR. W. B. SINGH, a technician with the Indian State Railways, is on a six-weeks visit to the English Steel Corporation, Limited, Sheffield, to widen his knowledge of the mechanized production of steel castings. He is in this country under the technical co-operation scheme of the Colombo Plan.

J. STONE & COMPANY (DEPTFORD), LIMITED, has, after two years of negotiations, ratified an agreement with Hungary for the supply of air-conditioning equipment to be fitted in all types of main-line railway coaches and railcars made in Hungary. The value of the contract is reported at about £1,000,000.

THE CINCINNATI SHAPER COMPANY'S factory at East Kilbride, near Glasgow, has reached the roofing stage and is now being equipped with machinery. It should be ready for production in September or October. Mr. David March, managing director, is planning operations from a temporary office in the new town.

THE CHEMICAL ENGINEERING BUILDING of the Manchester College of Science and Technology, at Jackson Street (London Road), Manchester, was officially opened by Sir Alexander Fleck on Monday, May 19. The building will house teaching and research laboratories for a rapidly expanding department in the University.

THE CENTRAL FILM LIBRARY (industrial section), Government Building, Bromyard Avenue, Acton, London, W.3, announces the availability of five foundry films of Italian origin, numbered V 473 to V 477. Before hiring, readers should ascertain whether or not this is a new issue because a similar set was exhibited a few years ago.

PROFESSOR MLADEN PAIC, director of the Institute of Physics and a member of the Rudjer Boskovic Federal Institute of Nuclear Physics, Zagreb, Jugoslavia, made a two-day visit to Sheffield on Tuesday and Wednesday, May 27 and 28. His programme was planned by Professor W. Sucksmith, head of the department of physics at Sheffield University.

G. & J. WEIR, LIMITED, the Glasgow engineers and founders, proposes to transfer the Cathcart undertaking of the company to a new wholly-owned subsidiary to take effect on December 31, 1958, on which date the name of the parent company will be changed to G. & J. Weir Holdings. The new subsidiary will then take the name G. & J. Weir.

METAL INDUSTRIES, LIMITED, is to merge, as from May 31, two of its wholly-owned subsidiaries, Fawcett Preston & Company, Limited, sugar machinery manufacturers, etc., of Bromborough, Wirrall (Ches), and Finney Presses, Limited, hydraulic engineers, etc., of Birmingham. The combined company will be known as Fawcett Preston & Company, Limited (incorporating Finney Presses). Manufacture is to be concentrated at Bromborough, and the Birmingham works will eventually be closed.

PART OF THE Carron Company's Low Foundry at Falkirk, where castings have been made for almost 100 years, is to be closed. The company stated recently that for many years it had operated two light-castings foundries, but for some time there had been hardly enough work to keep both fully employed. It had now been decided to concentrate light-castings

(Continued on page 672)

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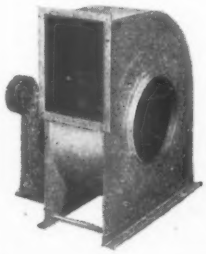

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BETTER EQUIPMENT FOR RAISING LOADS

News in Brief

(Continued from page 670)

production in the Mungal Foundry, which was being modernized and expanded. The Low Foundry would continue to manufacture baths.

TWO CONTRACTS together worth almost £320,000 have been awarded to the civil engineering division of Blackburn (Dumbarton), Limited, by the North of Scotland Hydro-Electric Board. The work, to be carried out at Loch Chliostair and Loch Gisla in Harris and Lewis, comprises construction of concrete dams, laying and jointing of about 2,500 yd. of 3-in. dia. pressure pipelines, erection of power houses, and construction of aqueducts as well as, in the loch Chliostair project on Harris, the construction of a tail-race.

A PARTY of 12 Polish engineering experts, including professors and doctors of engineering and factory managers in Poland, on a reciprocal goodwill visit to Britain, visited the works of William Asquith & Sons, Limited, machine-tool makers, Halifax, as well as their subsidiary, Modern Foundries, Limited, on Thursday, May 22. Afterwards the party was entertained to luncheon at David Brown Industries, Limited, Huddersfield, and then paid a visit to the firm's tractor division at Meltham and their Huddersfield works.

TWENTY-SIX FOUR-MOTOR ELECTRIC EQUIPMENTS for two-car multiple-unit trains, to be built at Wolverton works for the Manchester-Bury electrified line, have been ordered by British Railways from the English Electric works at Bradford. Replacing the present trains, now over 40 years old, the first of these multiple-unit trains will be introduced early next year. The equipment ordered will be built to operate on the 1,200 v. d.c. third-rail system already in use on the Manchester-Bury line, the only system of its kind in Britain.

TO MEET THE INCREASING DEMAND in the Canadian market, the Hunslet Engine Company, Limited, Leeds, has formed a new company, Hunslet Locomotives Canada, Limited, with registered offices at Haileybury, Ontario. Chairman of the new company is Mr. J. F. Alcock and Mr. W. J. Lecky is its first president. After-sales services, hitherto provided by the UK company in conjunction with Canadian representation, Lecky Machinery, Limited, and Gordon Russell, Limited, will be improved. Hunslet locomotives operate in most of the Canadian mining districts.

THE DUTCH COMPANY, N. V. Lips' Scheepsschroevengieterij (Lips' ships propeller foundry), of Drunen, which in addition to its foundry also runs a non-ferrous smelting works, a concrete plant, and a brass-tape rolling mill, is starting the manufacture of high-grade iron from scrap. Following extensive experiments, it is intended to commence the manufacture of steel grit, and production is expected to begin shortly. In 1938 the concern founded a ships' propeller foundry which is now amongst the six largest in the world. During the past 15 years the staff has increased from 60 to well over 1,000; more that 60 per cent. of the output is exported.

AT A MEETING of the Council of the University of Leeds on May 21, the pro-Chancellor, Brigadier J. Noel Tetley, announced that a gift of £50,000, the largest single response to the Leeds University Building Fund, had been promised by the Leeds engineering firm of R. W. Crabtree & Sons, Limited, manufacturers of rotary newspaper and lithographic offset machines, a firm which has been in existence since 1895. The Council signified its intention of giving the name of "The R. W. Crabtree Lecture Hall" to a large hall which is to be included in the new £1,500,000 engineering building. Brigadier Tetley stated that the Leeds building fund appeal had now passed its first objective of £600,000.

DESIGNED TO PRODUCE 10 TONS PER HOUR, the new galvanizing line at the Ebbw Vale works of Richard Thomas & Baldwins, Limited, is claimed to be one of Britain's largest and most modern plants. Nearly 700 ft. long, 36 ft. wide, and 30 ft. high, the line takes strip up to 48 in. in width. Driven by roller conveyor at speeds of up to 250 ft. per min. through all the stages of cleaning, heat-treatment, pickling, coating, shearing to size, and inspecting, the strip is processed in one continuous operation. Apart from electrical and mechanical maintenance staff only six men per shift are required to control the equipment. The Head Wrightson Machine Company, Limited, of Middlesbrough, were the main contractors, sub-contracting to Birlec, Limited, for the whole of the furnace equipment and atmosphere generators.

GIBBONS BROS., LIMITED, of Dudley, have received a contract to build coke ovens for a steel-making plant to be constructed as an extension of the South Durham Steel and Iron Company's West Hartlepool steelworks. The value of the contract, together with four large slab re-heating furnaces and a normalizing furnace already ordered for the same scheme, is more than £3,750,000. Completion of the first stage of construction is expected early in 1960, and of the whole contract in 1961. Col. W. E. Gibbons, chairman of the company, said that the contract, in addition to other orders in hand, would keep most divisions of the firm busy for the next two or three years. He added that the West Hartlepool extension would be one of the most up-to-date steel-plate-making plants in the world, and its production would fill a gap that British industry had felt severely in its plate supply for many years.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference BSB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

SOUTH MOLTON, June 25—Construction of approximately 220 yd. of 4-in. dia. spun-iron rising main. Documents from Lemon and Blizard, 1, Glenside, College Avenue, Mannamead, Plymouth. Deposit £3 3s.

LEEDS, June 12.—Provision and laying of 273 yd. 4-in. dia. steel and cast-iron pumping main (Contract No. 1). Documents from John H. Haiste and Partners, Belmont House, 20, Wood Lane, Headingley, Leeds, 6. Deposit £3 3s.

BURMA, June 9—Centrifugal pumping sets. (ESB/12645/58.)

PHILIPPINES, June 6—Pumps and iron piping. (ESB/12854/58/1CA.)

SALVADOR, June 4—Weighing machine. (ESB/13210/58.)

ST. GERMANS, CORN., June 4—Construction of 937 yd. of 5-in. class C spun-iron water main between reservoirs at Rame and Forder, near Cawsand, for the Rural District Council. Documents from the Council Offices, Lower Port View, Saltash. Deposit £2 2s.

MARKET BOSWORTH, LEICS, June 7—Barton-in-the-Beans water supply, for Rural District Council. Providing and laying about 1,400 yd. of 3-in. dia. spun-iron water mains, including valves, hydrants and fittings. Documents from the consulting engineers, Pick, Everard, Keay and Gimson, 6, Millstone Lane, Leicester. Deposit £2 2s.

SOUTH CARDIGANSHIRE—Teifi Pools scheme, Contract IIa, for Water Board, comprising laying of approximately 1,000 yd. of 6-in. dia. spun-iron pipes between Plwmp and Pentregat, and approximately 150 yd. of 3-in. dia. pipes at New Quay, together with incidental works. Documents from the Engineer, 36, Alban Square, Aberaeron. Deposit £3.

CHARLES CHURCHILL & COMPANY, LIMITED—Mr. G. E. K. Blythe has been appointed a director.

Bomber pilot rolls steel plate
—*and finds it not so different!*

Jim McCubbin has a rewarding job—in every sense.
Story by David Murray, writer and T.V. commentator

TEN YEARS AGO Jim McCubbin never imagined that he would ever be one of three Rollers in the big plate mill at Dalzell Steel Works, Motherwell, the most powerful of its kind in all Britain.

His youthful ambition was to be a veterinary surgeon. But the war set him on another course. In 1939, he joined the Royal Air Force as an Aircraftsman (2nd Class). He was soon a Sergeant Pilot, next a Flight Sergeant, and at length a Flight Lieutenant. As a bomber pilot he did two full tours of duty, one with Coastal and the other with Bomber Command. Coming out of the R.A.F. two years after the war, he flew for B.E.A. between Belfast, Glasgow and London for another couple of years. That brought him to 1949, when he thought it was time to start a career with his two feet well on the ground.

HE GOT ON BETTER WITH HIS COAT OFF

The problem for ex-Flight Lieutenant James McCubbin, D.F.C., was what that career ought to be. Like many another young fellow out of the war, he did not fancy going back to his books. Having a good look at the steel trade in his native town it struck him that he need not go any further, and he jumped at the chance of a clerk's job in the Dalzell Steel Works. There he saw that he might make better progress with his jacket off than with it on.

To get among the pounding machinery, he became a stocktaker at the big plate mill. His big chance came when a third shift was manned at the rolls. Getting into real working togs, he took on the job of Breaking Down – rolling the great white hot slabs to the proper width and passing them on to the Roller. In 1953, by which time he had learned a very great deal the hard way, he himself became a Roller, charged with finishing the plates to gauge.

The three Plate Mill Rollers, who work in shift turns, are the key production men at Dalzell; it was rapid promotion for a man who had never set foot in a steel plant until he was close on thirty. But Jim McCubbin had rightly figured that there would be as good chances on the production side, as in the more bookish branches. He has, of course, attended classes and read more than the odd book on steel making. But his main classroom has been the plate mill.

As he says . . . " It's just like flying. You're up against mass power and the forces of nature. Even to stay still, you've got to keep going . . . "

WELL PAID — AND SATISFYING

Off the job, which in view of its responsibility is well paid, even by professional standards, he likes good books and good music. In the summer he golfs. But his chief spare-time hobby is three-year-old, sloe-eyed, dark-haired Patricia Ellis McCubbin. Her middle name comes from grandfather Ben Ellis who played football years ago for Motherwell F.C.

To see Jim McCubbin and his two buddies on the other shifts, Bob Jaffrey and John Lang, putting through the plates, you might think that plate rolling is easy. But hot, plastic steel is what the Scots call " kittle stuff." The job in fact calls for as much stamina, nerve and operative skill as flying a big bomber.

That's why it's well paid. And that's one reason, though not the only one, why ex-Flight Lieutenant James McCubbin, D.F.C., went all out to be a Roller when he saw the chance.

As he says . . . " It feels as good to put in a good shift with no troubles, as to make the target and get back home."

This report was commissioned by the British Iron and Steel Federation, which believes that everyone in Britain should know the facts about Steel, and about the men and organisations that make it.

Personal

Mr. FRANK BRINSLEY is to retire from the post of technical service manager, Radiation, Limited, on May 31.

Mr. ALBERT G. EVANS has been appointed foundry manager of the engineering department at HM Dockyard, Devonport, Devon.

Mr. S. F. SMITH has been appointed sales manager of the industrial instruments division of Firth Cleveland Instruments, Limited, Treforest, Glamorgan.

Mr. THOMAS GRAHAM, assistant general secretary of the Amalgamated Union of Foundry Workers, has been elected to succeed Mr. JAMES GARDNER as general secretary on his retirement in August. Mr. Graham is 53.

Mr. STANLEY JOHN BURRAGE has been appointed a director of J. Parkinson & Son (Shipley), Limited, machine-tool makers, Canal Ironworks, Shipley, a subsidiary of Crofts Engineers (Holdings), Limited, of Bradford.

Mr. J. W. WHIMPENNY, joint managing director of W. H. Dorman & Company, Limited, manufacturing engineers and ironfounders, of Stafford, accompanied by the company's project development engineer, Mr. L. JOHNSON, is visiting South African and Central African agents of the company.

Mr. J. H. ROSS has been appointed managing director of Chamberlain & Hookham, Limited, a subsidiary of the General Electric Company, Limited. He succeeds Mr. J. S. CARTER, who has retired after 21 years as managing director and 50 years with the company. Mr. Ross, who was elected to the board of the subsidiary last year, has been sales manager of that company for the past eight years.

Lord ABERCONWAY has been appointed chairman of Constructors John Brown, Limited, a subsidiary of John Brown & Company, Limited, in succession to Sir STANLEY RAWSON, who has relinquished the chairmanship but remains on the board. Mr. ERIC MENSFORTH has been appointed deputy chairman and Mr. JOHN A. R. STANIFORTH, a director, becomes joint managing director with the present managing director, Mr. R. M. WYNNE-EDWARDS.

The Public Relations Officer of Wilson's Forge, Limited, steel and iron founders, of Bishop Auckland (Co. Durham), Alderman J. R. S. MIDDLEWOOD, has been elected chairman of Bishop Auckland Urban Council for the seventh time. Alderman Middlewood, who was awarded the O.B.E. in 1941, was made a Deputy Lieutenant of Durham County in 1946 and has been a member of Durham County Council since 1931. He is also a magistrate and for a time after the last war he was chief labour director of the Control Commission in Germany.

At the meeting of the Birmingham Chamber of Commerce on May 19, Mr. NORMAN LANCASTER, senior vice-president, succeeded Mr. R. P. S. BACHE as president. Mr. L. G. T. FARMER, of the Rover Company, Limited, became senior vice-president and Mr. PETER MIDDLEMAS of the Birmingham Railway Carriage and Wagon Company, Limited, was elected junior vice-president. The appointment of Mr. ROBERT C. BOOTH as secretary of the Chamber, was also announced. A 42-year-old barrister, Mr. Booth has been deputy secretary of the Manchester Chamber of Commerce since 1948. He taken up the appointment on September 1 in succession to Mr. W. J. LUXTON who is to become secretary of the London Chamber of Commerce.

Mr. H. WATSON-JONES has been appointed managing director of Richardsons Westgarth (Hartlepool), Limited, and elected to the board of the parent company, Richardsons Westgarth & Company, Limited, from June 1. Mr. T. P. EVERETT, formerly managing director at Hartlepool, becomes executive director of Richardsons Westgarth & Company, on atomic business based at London with Mr. HARRY FOTHERGILL, the company's consultant on atomic affairs. Mr. J. O. M. FISHER relinquishes the managing directorship at the Humber Graving Dock and Engineering Company, Limited, a subsidiary of Richardsons Westgarth, on June 30, on reaching retirement age. He will continue as a director. Mr. A. A. E. WISE, at present works director becomes managing director.

Steele & Cowlishaw, Limited, Cooper Street, Hanley, Stoke-on-Trent, announce an amalgamation of interests between Baker Perkins, Limited, of Peterborough and themselves which comes into operation forthwith. Following the reconstitution of the board of directors, Mr. A. I. BAKER (chairman of Baker Perkins, Limited), will be the chairman of Steele & Cowlishaw, Limited. Mr. F. LIMB will continue as the managing director of the company, and additional directors will be Mr. J. M. PEAKE (a director of Baker Perkins, Limited, and manager of their chemical division) and Mr. H. S. HARGREAVES (the deputy managing director of Baker Perkins (Exports), Limited. Mr. JOHN CAPEY, the present general manager of the company, will remain in this role as a member of the board and all existing works and technical staff at Hanley, together with the regional technical representatives, will continue unchanged.

Obituary

Mr. THOMAS WILLIAM AIKEN, sales director of the Bryan Donkin Company, Limited, mechanical and gasworks plant engineers, etc., of Chesterfield, died on May 20.

Mr. JOHN EDWARD JONES, who on his retirement after 40 years' service with Stewarts and Lloyds, Limited, in 1939 was chief cashier, died on May 13.

Mr. HAROLD HALL BAGNALL, chairman of the Industrial Welfare Society from 1951 to 1957, has died at his home at Westerham. During his term of office he played a major part in sponsoring the Duke of Edinburgh's Study Conference.

Mr. CHARLES F. ROGERS, director and general manager of Holbrooks Foundry, Limited, Coventry, died on May 20 at the age of 64. He had been ill for several months. Mr. Rogers was one of the four original co-founders of the firm and had been its manager since it opened in 1919.

Mr. PERCY B. HENSHAW, deputy chairman of Kayser Ellison & Company, Limited, steel manufacturers, Carlisle Works, Sheffield, and a director of Walter Spencer & Company, Limited, steel and tools, Warren Street, Sheffield, and of British Acheson Electrodes, Limited, died on Saturday, May 24, at the age of 75. He was elected president of the Crucible Steelmakers' Association in 1945.

The death is announced of Major FRANK H. BRAMWELL, B.SC., F.C.G.I., D.I.C., on May 7. Major Bramwell joined the board of directors of the Power-Gas Corporation, Limited, and Ashmore, Benson, Pease & Company, Limited, in April, 1949. He spent most of his working life with Imperial Chemical Industries, Limited, the latter part as chief engineer of their general chemicals division. He was keenly interested in all technical developments and up to his death was active in the affairs of civil, mechanical, electrical and chemical engineering institutions.

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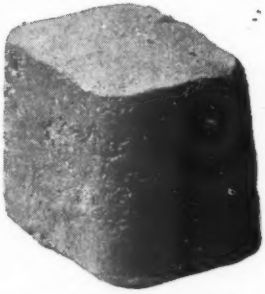

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Many cupola charges require the addition of manganese to combine with the sulphur and form the comparatively innocuous manganese sulphide. Manganese is also needed in the production of cast iron having a medium tensile strength and is essential when a steel scrap is incorporated in the charge.

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Raw Material Markets

Iron and Steel

Pig-iron production in all grades is adequate for current needs, while demands are below the capacity of the furnaces. Plentiful supplies of raw materials are available; ore deliveries from overseas are at good levels and for the first quarter of 1958 consignments showed an increase of about 355,000 tons above the corresponding period last year. Furnace-coke deliveries are also satisfactory and the blast furnaces have sufficient raw materials to enable them to increase outputs should the need arise.

The decline in demand is chiefly for the high-phosphorus grades of pig-iron and this is reflected in the reduced April output figures. The overall demand for light castings shows no sign of any appreciable improvement; in fact, judging by the spasmodic requirements of pig-iron by the foundries, the position would appear to have deteriorated. With the textile and many of the jobbing foundries, which also use this grade, very quiet and a decline in demand by some of the engineering foundries, order-books at the furnaces are very lean and they are compelled to resort to increased stocking.

Makers of the low-phosphorus irons are able to dispose of most of their makes, but overall production of this grade is now comfortably meeting demands. Castings for the motor-car trade continue to absorb large tonnages, and this industry is taking up the major portion of present outputs. Hematite pig-iron and the refined irons are plentiful and prompt deliveries can be given for the orders which arise. Good tonnages of the low-phosphorus irons and hematite continue to be sent to many other producers of high-duty castings. The foundries which cater for the machine-tool industry are feeling the effect of the decline in business in that trade.

The foundries have plentiful supplies of scrap, and foundry coke, ganister, limestone, and firebricks can be obtained as needed.

The re-rollers still find it difficult to obtain orders for small bars and light sections. Home requirements are very subdued and the keen competition abroad restricts business from overseas buyers. Most of the mills continue to operate on a four-day working week and it is difficult to obtain sufficient orders to make up rolling programmes. There is still a fairly good call for reinforcing rods, but makers are open to accept increased business.

Deliveries of steel semis from home steelworks are plentiful and a much larger demand than is at present forthcoming could be undertaken. Some supplies of defectives and crops are being taken up, but the call for these is only moderate.

Non-ferrous Metals

The reduction in the bank rate to 5½ per cent., the resumption of work at Chuquicamata, US buying on the London market, the rise in the US custom smelter price by ½ cent to 24 cents per lb., and the sharp fall in UK stocks by 1,125 tons are some of the bullish influences affecting copper. For all that, the LME price has remained steady, and the view is now being expressed that present quotations will be more or less maintained throughout the summer months. This is a happy situation and the outlook must be considered brighter than for some time past.

News from the United States is still not good, although a bright spot has been the way in which steel production has been gradually edging up to higher levels. It is still extremely difficult to get the US economic picture into proper focus. Government spokesmen tend to interpret statistics in a favourable light week after week, despite actual events proving them only half right. Wall Street is behaving well, although the bear position is the biggest since 1931. Car sales are not picking up; nor is the unemployment situation improving noticeably. At the same time, the cost of living index is still rising, although much more slowly than formerly.

The chairman of the Anaconda Company has also taken an optimistic view of the future and at the annual general meeting of the company last week he predicted an improvement in the US domestic demand for copper in the fourth quarter of this year. His opinion rested mainly on the belief that consumers had liquidated their stocks to the point where immediate delivery was requested for nearly all orders. Anaconda itself had committed for delivery nearly all its 1958 output, and present prices, the chairman said, did not justify production of higher cost copper. Nevertheless the cold, hard facts of the present situation are reflected in Anaconda's earnings in the first quarter of 1958, which totalled $6,130,898, against $18,156,320 in the first quarter of 1957.

Tin in London is still resting on the "floor," thereby necessitating intervention for small quantities of metal by the buffer stock manager. The long-held view here that the tin price must advance sharply sooner rather than later now appears to stand in need of some revision. The extent of Russian supplies and those of China are unknown but powerful factors, and in the absence of any strong buying from the US the buffer stock manager may well have to operate in the market for some months to come. In the US the market is quiet and the price is still hovering around 94½ cents per lb.

The feature of the lead market was the cut in the US price by ½ cent to 11½ cents a lb. last week. This was due to the inability of high cost US producers to compete with imported metal, which has been underselling the US price by up to 1 cent a lb. The present reduction does not, therefore, go far enough to close the gap and a further reduction to 11 cents may be looked for shortly. In the UK the market is featureless, although demand, on the whole, remains satisfactory and stocks are declining. Even so, the outlook on known factors is not bright and the LME quotation may well fall back a few pounds.

Zinc is also under pressure in the United States, although the price is still holding at 10 cents a lb. This price is already too low for economic comfort, so that every effort will be made to resist its falling to lower levels. In the UK the market is quiet, but the present price level is expected to hold.

Institution of Metallurgists

At the annual general meeting of the Institution of Metallurgists, held on May 20 at the Park Lane Hotel, London, Mr. W. E. Ballard, F.R.I.C., managing director of Metallization, Limited, was elected president of the Institution in succession to Mr. J. Mitchell, C.B.E.

The following elections were also made:—The president-elect is Professor A. J. Murphy, M.SC., whilst as vice-presidents, Dr. N. P. Allen, M.MET., D.SC., F.R.S., and Mr. G. Meikle, B.SC., were elected. Dr. E. G. West, B.SC., was re-elected honorary treasurer.

As members of Council the following were elected:—Professor J. G. Ball, B.SC., Mr. N. I. Bond-Williams, B.SC., Professor G. V. Raynor, M.A., D.PHIL., D.SC., and Mr. V. S. Kingswood, M.SC.

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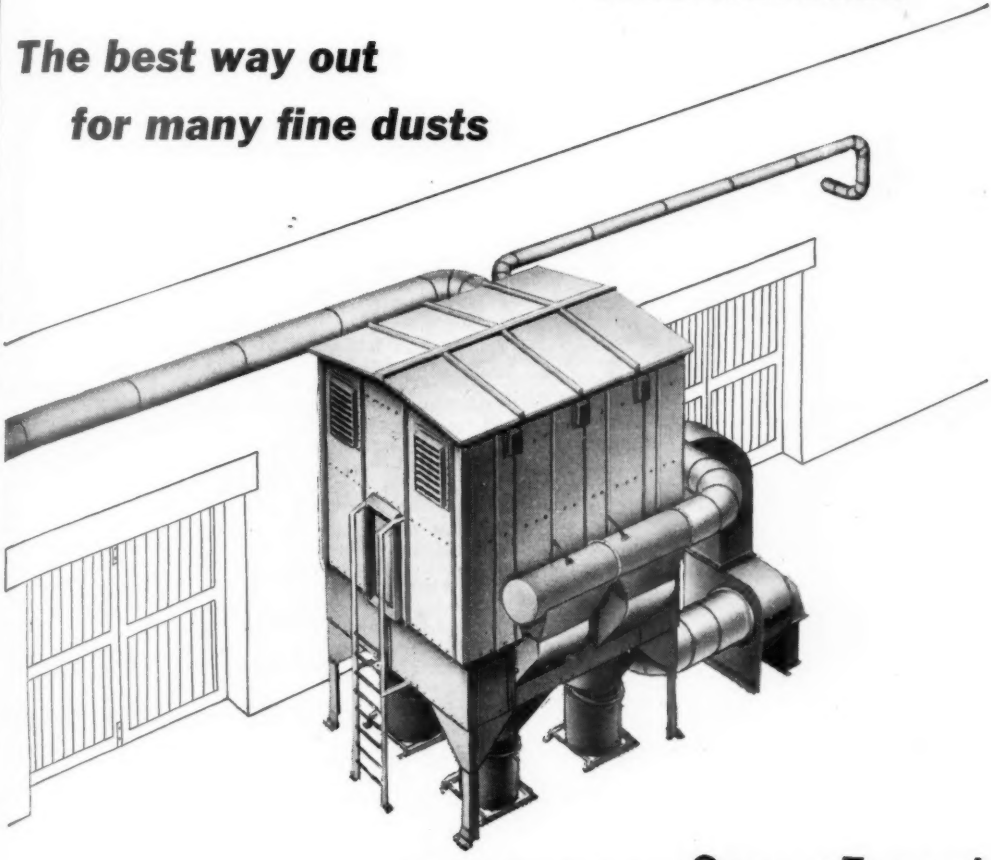

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

May 28, 1958

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.:—N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S.1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £47 10s. 0d. to £48 0s. 0d., scale 17s. 0d. per unit; 75 per cent. Si, £67 0s. 0d. to £67 10s. 0d., scale 17s. 0d. per unit.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 7s. 8d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 10s. 8d. per lb. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £91 10s. 0d., basis 60 per cent. Cr, scale 30s. 0d. to 30s. 6d., per unit; over 6 per cent. C, £87 10s. 0d., basis 60 per cent. Cr, scale 30s. 6d. per unit; 2 per cent. C,* 2s. 1d. to 1⅛d. per lb. Cr; 1 per cent. C,* 2s. 1½d. per lb. Cr; 0.15 per cent. C,* 2s. 2½d. per lb. Cr; 0.10 per cent. C,* 2s. 2¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 2½d. to 7s. 9½d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £265 0s. 0d.; 96/98 per cent., £295 0s. 0d.

Ferro-columbium.—65/72 per cent., Nb + Ta, 19s. 9d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £83 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., £32 15s. 6d.; tested, 0.08 to 0.33 per cent. C, £33 15s., 6d.; hard (0.41 to 0.60 per cent. C), £34 17s. 0d.; silico-manganese, £43 16s. 6d.; free-cutting, £36 14s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 2s. 0d.; boiler plates (N.-E. Coast), £44 12s. 0d.; floor plates (N.-E. Coast), £43 11s. 0d.; angles (N.-E. Coast), £39 16s. 6d.; joists (N.-E. Coast), £39 12s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats, 5 in. wide and under, untested soft basic, 50 tons and over: £40 0s. 6d; under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.; hoop and strip, coils, £39 0s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £44 16s. 0d.; black sheets (hand mill), 24g., £58 14s. 6d.; galvanized corrugated sheets, 24g., £66 16s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £68 10s. 0d., nickel-chrome, £99 11s. 0d.; nickel-chrome-molybdenum £111 19s. 0d.

NON-FERROUS METALS

Copper.—Cash, £181 10s. 0d. to £181 15s. 0d.; three months, £183 15s. 0d. to £184 0s. 0d.; settlement, £181 15s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 1s. 8⅞d. per lb., rods, 202s. 6d. per cwt. basis; 20 s.w.g., 235s. 9d. per cwt.

Tin.—Cash, £730 0s. 0d. to £730 10s. 0d.; three months, £733 0s. 0d. to £733 10s. 0d.; settlement, £730 10s. 0d.

Lead (Refined Pig).—Second half May, £71 0s. 0d. to £71 5s. 0d.; second half August, £71 17s. 6d. to £72 0s. 0d.

Zinc.—Second half May, £61 7s. 6d. to £61 10s. 0d.; second half August, £61 17s. 6d. to £62 0s. 0d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £95 5s. 0d.; rolled zinc (boiler plates), all English destinations, £93 0s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £83 10s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 5⅜d. per lb.; sheets to 10 w.g., 155s. 6d. per cwt.; wire, 2s. 2⅝d.; rolled metal, 155s. 6d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £128; B6 (85/15), £170 ; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £162; HTB2 (38 tons), — ; HTB3 (48 tons), —.

Gunmetal.—BS1400, LG2 (85/5/5/5), £153; LG3 (86/7/5/2), £163; G1 (88/10/2/½), £222; (88/10/2/1), £212.

Phosphor Bronze.—BS1400, PB1 (AID released), £238 per ton.

Phosphor Bronze Strip, etc.—Strip, 231s. 0d. per cwt.; wire, 3s. 6½d. per lb.; rods, 2s. 9¾d.; tubes, 2s. 9¾d.; chill cast bars: solids 2s. 10½d.; cored 2s. 11½d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 5d. per lb.; round wire, 10g. in coils (10 per cent.), 3s. 9¾d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 8¾d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £76 0s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £180 0s. 0d.; aluminium bronze (BS1400), AB1, £200; AB2, £215.

* Average 68-70 per cent.

Company News

UNITED STEEL COMPANIES, LIMITED—The board will announce an interim dividend for the year ending September 30 on June 18.

HILGER & WATTS, LIMITED, scientific instrument makers, of London, S.E.5—The company has acquired the preference and ordinary capital of Collimator Cases, Limited, makers of precision woodwork, etc., against the issue of 40,000 ordinary 5s. shares.

BEYER PEACOCK & COMPANY, LIMITED, locomotive engineers, etc., of Manchester—Mr. H. Wilmot, chairman of the company, reported at last week's meeting in London that the board had agreed in principle to the acquisition of two more companies. He declined to name the two companies concerned.

JOHN I. THORNYCROFT & COMPANY, LIMITED, engineers and shipbuilders, of London, S.W.1—The company is repeating the 3½ per cent. interim dividend on account of the year ending July 31, 1958, but the directors state that it must not be taken as any indication that the final will be maintained at 9 per cent.

METAL PRODUCTS COMPANY (WILLENHALL), LIMITED—The company is reducing the dividend from 22½ per cent. to 15 per cent. for the year ended March 31, 1958, with a final of 7½ per cent. After tax of £41,500 (£47,627) and crediting over-provided tax of £1,249 (£17,137), the net profit stands at £29,191 (£49,284).

WILLIAM SUGG & COMPANY, LIMITED, engineers and non-ferrous founders, of London, S.W.1—The company has postponed the dividend until the results are known for the year to June 30, 1958. Last year an interim of 5 per cent. was followed by a final of 5 per cent., less tax, plus a capital distribution of 2½ per cent., not subject to tax.

PULSOMETER ENGINEERING COMPANY, LIMITED—The company states that arrangements are almost finalized for the acquisition of all issued capital of two further companies. As recent acquisitions have resulted in all capital being issued, the company proposes to increase the authorized total from £730,000 to £980,000 by the creation of a further 1,000,000 ordinary 5s. shares.

RADIATION, LIMITED—Directors of the company and Parnall (Yate), Limited, have agreed that the proposed merger can best be effected by the company making an offer for the acquisition of the £750,000 issued capital of Parnall (Yate) on the basis of 12s. in cash and one £1 ordinary share in Radiation for every two ordinary 5s. Parnall units. The existing board of Radiation will be increased by four directors from the existing board of Parnall.

ELLIOTT-AUTOMATION, LIMITED—When Associated Automation, Limited, and Elliott Bros. (London), Limited, formed themselves into the present company, it was forecast by the board that the dividend for the five-month period to December 31 would be 4½ per cent. This estimate has proved to be correct and equals 8 per cent. on the ordinary shares of Associated Automation and 20 per cent. on the ordinary of Elliott Bros. It is the equivalent of 10 per cent. for a full trading year on the present company's shares. Profits for the year amounted to £1,139,934 before depreciation, but after deducting £216,447 attributable to outside interests. They included the profits of the recent acquisition, the Rotameter Manufacturing Company, Limited, for the three months to December 31. Net profits after tax were £411,651.

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GLASGOW, C.2. 93, Hope Street, Central 9969

M

CLASSIFIED ADVERTISEMENTS

PREPAID RATES: Fifteen words for 7/6 (minimum charge) and 4d. per word thereafter. Box Numbers 2/6 extra (including postage of replies). Situations wanted 2d. per word throughout.

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Monday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

EXPERIENCED FOUNDRYMAN (38) seeks position as Manager. Time served all branches, ferrous, non-ferrous, technical, managerial, and representative positions previously held. Midlands preferred.—Box EF831, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER, free, desires situation. 15 years' executive experience machine tool, general engineering, and general jobbing. Box FM801, FOUNDRY TRADE JOURNAL.

FOUNDRY WORKS MANAGER (37) desires change. Technical and practical qualifications, experience jobbing and repetition work, grey iron and steel, conversant with CO_2, shell moulding, sales. Box FW802, FOUNDRY TRADE JOURNAL.

EXECUTIVE TYPE REPRESENTATIVE; speciality salesman, M.I.B.F. Experienced foundry and engineering practice, inspection, B.S. materials, plant, etc., desires full-time position with modest monthly salary, commission, own car exes., and twice yearly bonus on agreed turnover. Based Northants. Box ET800, FOUNDRY TRADE JOURNAL.

SENIOR TECHNICAL REPRESENTATIVE, 35, Grammar School education, 10 years' experience selling all grades iron and non-ferrous castings to major concerns and Government Departments, desires sales managership. Box ST821, FOUNDRY TRADE JOURNAL.

TECHNICAL REPRESENTATIVE with foundry experience wishes to represent a foundry for cast iron non-ferrous castings and diecastings. First-class connections in London and Home Counties, expenses and commission. Box TR822, FOUNDRY TRADE JOURNAL.

FOUNDRY WORKS MANAGER desires change. Would accept similar position home or abroad with progressive firm. Fully conversant with highly mechanised plant and jobbing castings up to 40 tons. Experienced iron, steel and non-ferrous. Thorough practical and technical knowledge of modern foundry practice. Results guaranteed. Age 56. M.I.B.F.—Box FW813, FOUNDRY TRADE JOURNAL.

FOUNDRY MANAGER, 49, M.I.B.F., grey, high duty, malleable (whiteheart), non-ferrous. Life experience trade, practical, technical, commercial, sales. Loyal and conscientious. Requires early appointment small/medium foundry, preferably West Midlands, country considered. Secure, permanent position sought with prospects for results. Experience oz. to 5 tons repetition, jobbing, bench, plate, etc., on wide range of castings. Box FM825, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

GRAPHITE SALES MANAGER required to direct important department. Personality who can organise and direct.—Please write DOHM, LTD., 167, Victoria Street, S.W.1.

METAL PATTERN-MAKER to take charge of developments in Rainwater Goods for machine and floor. Must be experienced in modern methods. First-class conditions and wages. South Lancs. district. Box MP824, FOUNDRY TRADE JOURNAL.

THE MANGANESE BRONZE & BRASS CO., LTD., Dock Road, Birkenhead, require a METALLURGIST, aged 25-35, to take charge of the Works Control Section of their Laboratory. Salary offered in range of £750 to £1,150. Good pension scheme.—Applications should give full details of qualifications and experience, and be addressed to the CHIEF METALLURGIST.

FOUNDRY MANAGER required. Approximately 100 tons per week capacity. Only suitable for man of proved ability and experience. Management background essential. Pensionable. A high salary will be paid to successful applicant. —Give full details of age, training, and experience to Box FM818, FOUNDRY TRADE JOURNAL.

SENIOR SALES EXECUTIVE, aged 30-40 years, required by one of the largest importers, producers and sellers of ferro-alloys and metals to the iron, steel and non-ferrous industries in the U.K., Commonwealth, and elsewhere. A graduate is required with a degree in metallurgy or equivalent qualification, and possessing knowledge of steelmaking and ironfounding.—Write, giving full details of age, qualifications and previous experience, to PERSONNEL OFFICER, Union Carbide, Ltd., 103, Mount Street, London, W.1.

METALLURGIST.

NON-FERROUS METALS DEPARTMENT of large engineering establishment on North East Coast has immediate vacancy for an experienced WORKS METALLURGIST.

The Department, which comprises Brass Foundry, Electric Melting Shop, Rolling Mills and Extrusion Presses, handles principally Copper and Copper Alloys, and the successful applicant will be required to deal with production, control and development problems, and to work in collaboration with the central chemical and metallurgical laboratories.

The post carries an attractive salary, and a superannuation scheme is in operation.

Candidates, who should possess a University Degree, are invited to write, giving in confidence age and full details of practical and educational qualifications, to Box MN810, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*contd.*

FREE-LANCE REPRESENTATIVE wanted, to handle sale of Moulding Machines, Graphite and Plumbago. Commission basis.—Box FL829, FOUNDRY TRADE JOURNAL.

METALLURGIST, with sound knowledge of cupola control, for mechanised and jobbing foundry, producing High Duty Cast Iron.—Box MW828, FOUNDRY TRADE JOURNAL.

SKILLED Wood or Metal PATTERN-MAKER required for medium sized Malleable Iron Foundry. Good rates of pay and bonus.—Apply PERSONNEL OFFICER, Britannia Iron & Steel Works, Ltd., Bedford.

A YOUNG, energetic, FOUNDRYMAN is required to control the Machine Moulding Section of a London Foundry. A good basic training is essential and there are excellent prospects for the right man.—Apply Box AY826, FOUNDRY TRADE JOURNAL.

FOUNDRY TECHNICIAN required, age 21/26, completed National Service, with experience in cupola operation, sand testing and quality control.—Write in confidence, stating age, experience, and salary required, to FOUNDRY MANAGER, Richard Haighton, Ltd., Canning Street, Burnley, Lancs.

A FIRST-CLASS FOUNDRYMAN, aged 30/35, is required as ASSISTANT to the FOUNDRY FOREMAN of a medium sized Foundry in the London area. A good basic training in both green and dried sand moulding is essential, also some experience in labour control.—Apply Box AF827, FOUNDRY TRADE JOURNAL.

MELTING SHOP MANAGER required by progressive Company, Lancashire. Must have experience of economic production of high quality iron to close tolerances from Acid and Basic cupolas. Supervisory experience and ability to organise and manage essential. Pension scheme in operation; age limits 30/45 years.—Full details of experience and salary required to Box MS816, FOUNDRY TRADE JOURNAL.

ESTABLISHED PUBLIC COMPANY, Non-ferrous Founders, Sand, Shell, and Gravity Die Foundries, require REPRESENTATIVE or AGENT to further existing business in the Lancs. and Cheshire area. Experience in this type of business essential; details of age and previous positions held; salary plus commission; car provided. Existing staff have been informed of this vacancy.—Box EP817, FOUNDRY TRADE JOURNAL.